Before The Federal Energy Regulatory Commission

DRAFT
APPLICATION FOR NEW LICENSE

OROVILLE DIVISION, STATE WATER FACILITIES
FERC PROJECT NO. 2100

VOLUME II

PRELIMINARY DRAFT ENVIRONMENTAL ASSESSMENT PROGRESS SUMMARY

State of California
The Resources Agency
Department of Water Resources

APRIL 30, 2004

Public Document

BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION
DRAFT APPLICATION FOR NEW LICENSE

APPLICATION OF
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

FOR THE
OROVILLE DIVISION, STATE WATER FACILITIES
FERC PROJECT NO. 2100

PURSUANT TO:
Code of Federal Regulations
Title 18-Conservation of Power and Water Resources
Chapter 1, Subchapter B
Part 4, Subpart D, Section 4.38
Part 4, Subpart F, Sections 4.50 and 4.51
and
Part 16, Subpart B

This is Volume II of the Application of the undersigned for a new License for the Oroville Facilities, FERC No. 2100, made this _____ day of __________, 20___.

THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By: ______________________
Lester A. Snow
Director

Letter of Transmittal

Volume I: Draft Application and Technical Exhibits
Initial Statement
Exhibit A: Project Description
Exhibit B: Project Operation and Resource Utilization
Exhibit C: Construction History and Proposed Construction Schedule
Exhibit D: Statement of Costs and Financing
Exhibit H: Information Required for New License *(Note: Exhibit H is not included with Draft License Application. It will be submitted to FERC with the Final License Application).*

Volume II: Preliminary Draft Environmental Assessment (PDEA) Progress Summary
Section 1.0 Introduction
Section 2.0 Purpose and Need for Action
Section 3.0 Development and Description of the Proposed Action and Alternatives
Section 4.0 Affected Environment and Environmental Consequences
Section 5.0 Other Statutory Requirements
Section 6.0 Developmental and Economic Analysis
Section 7.0 Comprehensive Development Analysis and Recommendations
Section 8.0 Recommendations of Fish and Wildlife Agencies
Section 9.0 Consistency with Comprehensive Plans
Section 10.0 Literature Cited
Section 11.0 List of Preparers and Reviewers
Section 12.0 List of Recipients

Volume III: *(not for public distribution)*
Exhibit F - Supporting Design Report and General Design Drawings
Exhibit G – Project Maps

Note: Volume III is being provided to FERC only. It contains Critical Energy Infrastructure Information (CEII), which under FERC's Order No. 630-A is being withheld from public viewing. To view this information, a CEII request may be filed under the provisions of 18 C.F.R. Section 388.113 or a FOIA request may be filed under 18 C.F.R. Section 388.108.

The California Public Records Act does not require the disclosure of any record the disclosure of which is exempted or prohibited pursuant to federal law (Cal. Govt. Code Section 6254(k)).

DRAFT APPLICATION FOR NEW LICENSE

OROVILLE DIVISION, STATE WATER FACILITIES
FERC PROJECT NO. 2100

VOLUME II: Preliminary Draft Environmental Assessment (PDEA) Progress Summary

REPORT SUMMARY

This report summarizes the status of key environmental studies and documents that are being prepared to support relicensing of the Feather River Hydroelectric Project (also referred to as the Oroville Division, State Water Facilities or simply the Oroville Facilities). As the current license expires in 2007, the California Department of Water Resources (DWR) must apply to the Federal Energy Regulatory Commission (FERC) by January 31, 2005, to request renewal of its license to operate the hydroelectric facilities for another 30–50 years. This report focuses on describing the studies, data, and methodology that will be used to prepare the Preliminary Draft Environmental Assessment (PDEA), which will be submitted to FERC with the final License Application in January 2005.

Some of the sections in this report are preliminary versions of sections to be contained in the January 2005 PDEA, while others contain resource area–specific "road maps" outlining the environmental analyses to be undertaken once the project alternatives are defined by DWR. The report seeks to inform the participants in the collaborative relicensing process as to what has been learned thus far and tasks that remain to be completed. This draft document will evolve into a complete PDEA after the project alternatives are defined as the results of DWR's 71 ongoing technical studies are incorporated.

This Progress Summary report serves the following purposes:

- Provides an overview of the Oroville Facilities and relicensing activities to date.
- Provides abstracts for the environmental studies that will be used to define the affected environment; develops potential protection, mitigation, and enhancement (PM&E) measures; and supports the development of the Proposed Action and other project action alternatives (referred to as the "primary action alternatives") that will be presented and evaluated in the January 2005 PDEA.
- Defines the No Action Alternative, which is an important point of comparison for the primary action alternatives to be defined and assessed in the January 2005 PDEA. (This alternative is one of the "primary alternatives" referred to throughout this document.)
- Presents resource area–specific "road maps" outlining the environmental analyses to be undertaken following the definition of the primary alternatives, and in preparation for filing the final License Application.
- Provides another opportunity for interested parties to comment on the FERC relicensing process and offers additional information that might be helpful to DWR's environmental analyses.

Please see Chapter 1.0, Introduction, for a complete overview of the purpose and contents of this Progress Summary report, as well as information about how to contact DWR to share your comments and suggestions.

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

1995 WQCP	*1995 Water Quality Control Plan for the San Francisco Bay/ San Joaquin Delta Estuary*
4WD	four-wheel drive
AADT	average annual daily traffic
ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
af	acre-feet
afy	acre-feet per year
ALP	Alternative Licensing Process
ANOVA	analysis of variance
APE	Area of Potential Effects
AQAP	Air Quality Attainment Plan
ARB	California Air Resources Board
BA	Biological Assessment
Basin Plan	Water Quality Control Plan
BCAG	Butte County Association of Governments
BCAQMD	Butte County Air Quality Management District
BIA	Bureau of Indian Affairs
BIC	Boat-in Camp
BKD	bacterial kidney disease
BLM	U.S. Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
BP	before present
BR	Boat Ramp
CAAQS	California ambient air quality standards
CALFED	CALFED Bay-Delta Program
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CDF	California Department of Forestry and Fire Protection
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act

CFR	Code of Federal Regulations
cfs	cubic feet per second
CHP	California Highway Patrol
City	City of Oroville government
CNPS	California Native Plant Society
COA	Coordinated Operations Agreement
County	Butte County government
CRHR	California Register of Historical Resources
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
CWHR	California Wildlife Habitat Relationships Database
D-1641	Decision 1641
dBA	A-weighted decibel
DBW	California Department of Boating and Waterways
Delta	Sacramento–San Joaquin Delta
DFG	California Department of Fish and Game
DHS	California Department of Health Services
DO	dissolved oxygen
DOC	California Department of Conservation
DPR	California Department of Parks and Recreation
DSOD	Division of Safety of Dams
DTSC	California Department of Toxic Substances Control
DUA	Day Use Area
DWR	California Department of Water Resources
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FESA	Federal Endangered Species Act
FONSI	Finding of No Significant Impact
FPA	Federal Power Act
FRRPD	Feather River Recreation and Park District
FRSA	Feather River Service Area
GIS	geographic information systems

HMMP	hazardous materials management plan
hp	horsepower
HVAC	heating, ventilation, and air conditioning
I-	Interstate route
IFIM	Instream Flow Incremental Methodology
IHN	infectious hematopoetic necrosis
IIP	Initial Information Package
ISO	Independent System Operator
KOP	key observation point
kV	kilovolt
kWh	kilowatt-hour
L_{eq}	equivalent noise level
LOFEC	Lake Oroville Fish Enhancement Committee
LOS	level of service
LOSRA	Lake Oroville State Recreation Area
m	meter
maf	million acre-feet
mg/L	milligrams per liter
mph	miles per hour
msl	mean sea level
MTBE	methyl tertiary butyl ether
MVA	megavolt ampere
MW	megawatt
MWh	megawatt-hour
MYBP	million years before present
NAAQS	national ambient air quality standards
NEPA	National Environmental Policy Act
NF	National Forest
NGO	nongovernmental organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service (now called NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
NO_x	oxides of nitrogen
NO_2	nitrogen dioxide

NP	National Park
NPS	National Park Service
NP-15	North Path 15
NRHP	National Register of Historic Places
NSVAB	Northern Sacramento Valley Air Basin
O&M	operations and maintenance
OCAP	Operating Criteria and Plan
OCO	Operations Control Office
OFD	Oroville Field Division
OHP	California Office of Historic Preservation
OHV	off-highway vehicle
OPR	Governor's Office of Planning and Research
ORAC	Oroville Recreation Advisory Committee
ORV	off-road vehicle
OWA	Oroville Wildlife Area
PAH	polycyclic aromatic hydrocarbons
PBDE	polybrominated diphenyl ether
PCB	polychlorinated biphenyl
PDEA	Preliminary Draft Environmental Assessment
PG&E	Pacific Gas and Electric Company
PM&E	protection, mitigation, and enhancement
$PM_{2.5}$	fine particulate matter 2.5 micrometers or less in diameter
PM_{10}	respirable particulate matter 10 micrometers or less in diameter
ppm	part(s) per million
PRC	Public Resources Code
PWC	personal watercraft
RA	Resource Action
RAIF	Resource Action Information Form
RAM	Resource Area Manager
RD	reclamation district
RM	river mile
ROG	reactive organic gases
RST	rotary screw trap
RV	recreational vehicle
RVA	Range of Variability Approach

RWQCB	Regional Water Quality Control Board
SBF	State Board of Forestry
SCE	Southern California Edison Company
SCOR	Sewerage Commission—Oroville Region
SD1	Scoping Document 1
SHPO	State Historic Preservation Officer
SO_x	oxides of sulfur
SO_2	sulfur dioxide
SP-	Study Plan Report
SR	State Route
SVRA	State Vehicular Recreation Area
SWC	State Water Contractors
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWRDS	State Water Resources Development System
taf	thousand acre-feet
TMDL	total maximum daily load
UNFFR	Upper North Fork Feather River
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VELB	valley elderberry longhorn beetle
WQCP	Water Quality Control Plan
WY	Water Year

1.0 INTRODUCTION

1.1 PURPOSE OF THIS PDEA PROGRESS SUMMARY

This Preliminary Draft Environmental Assessment (PDEA) Progress Summary provides information on the status of environmental studies being conducted for the Federal Energy Regulatory Commission (FERC) relicensing of the Feather River Hydroelectric Project No. 2100 (also referred to as Oroville Division, State Water Facilities or simply the Oroville Facilities). The environmental studies are being carried out by the California Department of Water Resources (DWR) in collaboration with federal, State, and local agencies, as well as tribes, nongovernmental organizations, interested parties, and members of the public.

This document provides as much useful information as is available at this point in the collaborative relicensing process. It intends to inform participants in the collaborative process about what has been learned thus far and tasks that remain. A "PDEA Progress Summary" is not mandatory under the FERC collaborative relicensing process, but it is DWR's intention to use this report as a tool to give broad distribution of information compiled to date. This report will evolve into a complete PDEA after the project alternatives are defined and as the results of DWR's 71 ongoing technical studies are incorporated. DWR will then file the PDEA on or before January 31, 2005, with FERC as a component of the final License Application.

Most environmental issues related to this relicensing are expected to be fully addressed in the January 2005 PDEA; however, a number of issues likely will require further analysis and consideration. Environmental issues requiring further analysis and consideration after January 31, 2005 will be addressed subsequently in formal environmental review processes under the National Environmental Policy Act (NEPA). FERC will use the January 2005 PDEA while preparing either an environmental impact statement (EIS) or environmental assessment (EA) for compliance with NEPA. DWR may also submit a supplemental information package to FERC before the agency completes its EIS or EA. These required federal environmental documents will fully address all issues associated with relicensing the Oroville Facilities. DWR expects the FERC EIS or EA to be completed, and certified as complete, before the existing FERC license expires on January 31, 2007.

This document serves the following purposes:

- Provides an overview of the Oroville Facilities and relicensing activities to date.
- Provides abstracts for the environmental studies that will be used to define the affected environment; develops protection, mitigation, and enhancement (PM&E) measures; and supports the development of the Proposed Action and other project action alternatives (referred to throughout this document as the "primary action alternatives").

- Defines the No Action Alternative, which is an important point of comparison for the primary action alternatives to be defined and assessed in the January 2005 PDEA. (This alternative is one of the “primary alternatives” referred to throughout this document.)
- Presents resource area–specific “road maps” outlining the environmental analyses to be undertaken following the definition of the primary alternatives, and in preparation for filing the final License Application.
- Provides another opportunity for interested parties to comment on the FERC licensing process and offers additional information that might be helpful to DWR’s environmental analyses.

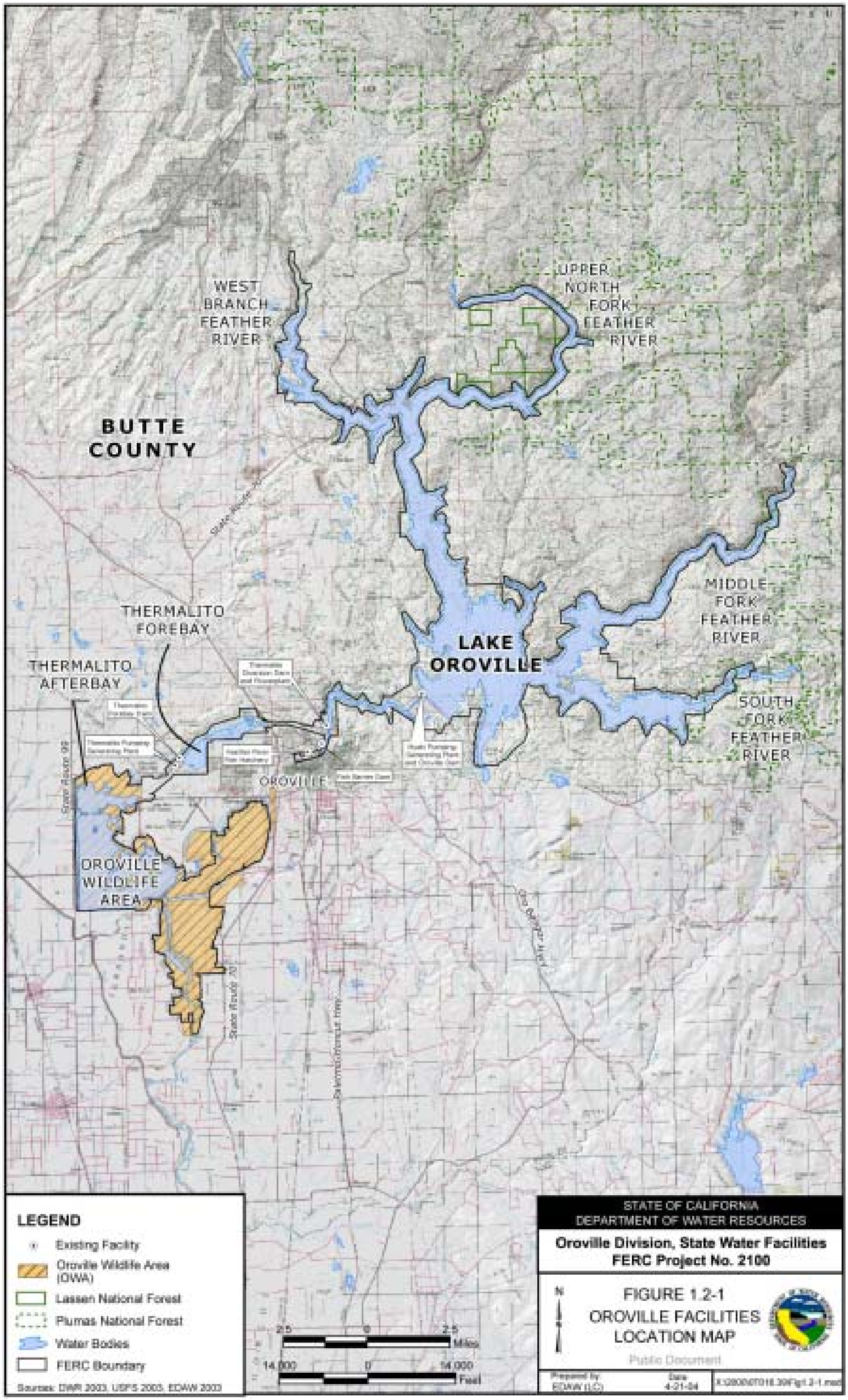
These purposes reflect the amount of information that is available to date. Appendix E contains abstracts of the technical study plan reports that are being produced. A substantial amount of additional information will be available for review in the January 2005 PDEA.

1.2 BRIEF DESCRIPTION OF THE PROPOSED ACTION

The Oroville Facilities are located on the Feather River in Butte County, California, approximately 70 miles north of the City of Sacramento (see Figure 1.2-1). Appendix B provides a detailed overview of the Oroville Facilities and their operations. Oroville Dam, Lake Oroville, and related facilities occupy 41,100 acres in the foothills of the Sierra Nevada mountain range. The Oroville Facilities have a combined license generating capacity of 762 megawatts (MW). DWR operates and maintains the Oroville Facilities under the terms and conditions of a FERC license dated February 11, 1957. This license will expire on January 31, 2007. FERC requires DWR to file an Application for New License on or before January 31, 2005, two years before the license expiration date.

The NEPA Proposed Action, to be fully addressed in the January 2005 PDEA and the subsequent FERC EIS or EA, is the continued operation and maintenance of the Oroville Facilities for electric power generation, including the implementation of specific terms and conditions to be considered for inclusion in a new FERC license, as well as those portions of any settlement agreement that might be developed through the collaborative process that are within FERC’s jurisdiction.

Through the collaborative process, DWR is developing potential terms and conditions for the FERC License and for the settlement agreement. These terms and conditions (e.g., reflecting selected Resource Actions/Protection, Mitigation and Enhancement Measures, environmental mitigation measures, agreements with other agencies, etc.) are expected to be further defined during 2004, and will be evaluated in the January 2005 PDEA and the subsequent FERC EIS or EA.



WEST BRANCH FEATHER RIVER
UPPER NORTH FORK FEATHER RIVER
BUTTE COUNTY
LAKE OROVILLE
MIDDLE FORK FEATHER RIVER
SOUTH FORK FEATHER RIVER
THERMALITO FOREBAY
THERMALITO AFTERBAY
OROVILLE
OROVILLE WILDLIFE AREA
State Route 70
State Route 99
LEGEND
Existing Facility
Oroville Wildlife Area (OWA)
Lassen National Forest
Plumas National Forest
Water Bodies
FERC Boundary
Sources: DWR 2003, USFS 2003, EDAW 2003
2.5 0 2.5 Miles
14,000 0 14,000 Feet
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
FIGURE 1.2-1
OROVILLE FACILITIES
LOCATION MAP
Public Document
Prepared by: EDAW (LC)
Date 4-21-04

1.3 ORGANIZATION OF THIS PDEA PROGRESS SUMMARY

Chapter 1.0, Introduction, explains the organization this PDEA Progress Summary, provides a brief description of the Proposed Action, and gives a summary of the collaborative relicensing activities to date.

Chapter 2.0, Purpose and Need for Action, defines the Proposed Action's purpose and need under NEPA. This chapter also addresses needs and commitments related to power, water supply, flood management, recreation, and environmental benefits.

Chapter 3.0, Development and Description of the Proposed Action and Alternatives, provides an overview of the Oroville Facilities as well as current operations and environmental commitments, facilities, and programs that would continue under the No Action Alternative. This chapter also describes the process being used to define the Proposed Action and other action alternatives that will be analyzed in detail for the January 2005 PDEA.

A brief overview of the affected environment is provided, as it informs the development of the alternatives. Also included is a list of potential "resource actions" (referred to in this document as "PM&E measures") that have been developed in collaboration with the relicensing participants.

Chapter 4.0, Affected Environment and Environmental Consequences, provides resource area–specific "road maps" describing the environmental analyses that will be completed for the January 2005 PDEA. These analyses will be completed after the primary alternatives have been defined. The road maps include brief summaries of the types and causes of potential environmental impacts to be assessed, along with methods of analysis.

Chapters 5.0–9.0 contain road maps for other required topics. These sections will be completed once key technical study results are available and the primary action alternatives have been defined.

Chapters 10.0–12.0 provide a list of literature cited, a list of preparers, and a list of recipients who have been notified of the availability of the draft License Application.

Appendices A–F provide detailed information as follows:

- Appendix A—Scoping, Consultation, and Compliance
- Appendix B—Oroville Facilities Description
- Appendix C—Historical Hydrology
- Appendix D—Modeling Tools
- Appendix E—Technical Study Plan Abstracts

- Appendix F—Potential Resource Actions/PM&E Measures

1.4 THE COLLABORATIVE RELICENSING PROCESS

DWR is applying for a new license for the Oroville Facilities using the FERC Alternative Licensing Procedures (ALP), in which information and analyses relevant to relicensing are developed in collaboration with federal, State, and local agencies as well as tribes, nongovernmental organizations, interested parties, and members of the public. In October 1999, DWR sent out an informal mailer to known and potentially interested government agencies, Native American Tribes, and other interested parties and organizations to initiate development of a mailing list of those interested in the Oroville Facilities relicensing. In addition to inviting involvement in the relicensing process, DWR initiated discussion with resource agencies and potentially interested parties regarding the relicensing process in early 2000.

The Oroville Facilities relicensing process has involved extensive coordination and commitment by a variety of parties over the past several years. The objective of this collaborative process is to develop a settlement agreement on various issues and Resource Actions/PM&E measures (protection, mitigation, and enhancement measures). FERC will consider the settlement agreement, along with information and analyses contained in the final License Application (January 2005), in its decision to issue a new hydroelectric license. The following describes the collaborative ALP process adopted by DWR for the Oroville Facilities relicensing.

The collaborative process is guided by “process protocols” (developed by members of the Collaborative), which provide a framework for communication, cooperation, and consultation among all relicensing participants throughout the collaborative process. As specified in the process protocols, the Collaborative functions on three levels represented by a Plenary Group, five resource-specific work groups, and issue-specific task forces (as needed). Interested parties are encouraged to observe and/or participate in the collaborative process, as set forth in the process protocols. Each of the three collaborative levels is described below. Meeting logistics and summaries of Plenary Group and work group meetings can be viewed on DWR’s Oroville Relicensing website (the website) at http://orovillerelicensing.water.ca.gov or in the Sacramento or Oroville Public Reference Files.

The Plenary Group is composed of spokespersons for stakeholder groups involved in the relicensing process. Table 1.4-1 lists the entities participating in the Plenary Group. The Plenary Group is responsible for maintaining a global perspective on the relicensing process while shepherding the Collaborative through the successful negotiation of a settlement agreement. The Plenary Group oversees the progress of the five work groups and determines how recommendations and proposals interrelate and interact with other issues and resource needs. A list of the Plenary Group meetings held through April 1, 2004 is provided in Table A-1 of Appendix A. Summaries of Plenary Group meetings, including decisions and action items, can be viewed on the website at http://orovillerelicensing.water.ca.gov or in the Sacramento or Oroville Public Reference Files.

Table 1.4-1. Plenary Group participants.

Federal Agencies	State Agencies	Local Government
∉ National Oceanic and Atmospheric Administration (NOAA) Fisheries ∉ National Park Service ∉ U.S. Forest Service (USFS), Plumas National Forest (NF) ∉ U.S. Army Corps of Engineers (USACE) ∉ U.S. Fish and Wildlife Service (USFWS)	∉ California Department of Fish and Game (DFG) ∉ DWR ∉ California Department of Parks and Recreation (DPR) ∉ State Water Resources Control Board (SWRCB) ∉ California Department of Boating and Waterways (DBW)	∉ Butte County ∉ City of Oroville ∉ Feather River Recreation and Park District (FRRPD) ∉ Lake Oroville Joint Powers Authority ∉ Oroville Chamber of Commerce ∉ City of Yuba City ∉ Yuba County Water Agency
Native American Tribes	**State Water Project Contractors**	**Nongovernmental Organizations**
∉ Berry Creek Rancheria of Konkow Maidu Indians ∉ Konkow Valley Band of Maidu ∉ Enterprise Rancheria ∉ Mooretown Rancheria	∉ Various State Water Contractors (SWC)	∉ American Rivers ∉ American Whitewater/Chico Paddleheads ∉ Berry Creek Citizens Committee ∉ Butte County Tax Payers Association ∉ Butte Sailing Club ∉ Butte County Citizens for Fair Government ∉ California Horsemen's Association—Region II ∉ Equestrian Trail Riders/Hikers ∉ Feather River Low Flow Alliance ∉ JEM Farms ∉ Oroville Foundation of Flight ∉ Oroville Recreation Advisory Committee (ORAC)* ∉ Natural Heritage Institute ∉ General public

** ORAC includes local representatives from the Butte Sailing Club, Citizens for Fair and Equitable Recreation, Lake Oroville Fish Enhancement Committee, Butte County Citizens for Fair Government, the City of Oroville, Butte County, and the Oroville Chamber of Commerce.*

Work Groups have been established in five resource-specific areas and are responsible for identifying resource issues, developing study plans, considering existing and new information (including study reports), and making recommendations to the Plenary Group on PM&E measures. The five work groups and their assignments are described below, with participants listed in Table 1.4-2. A list of all work group meetings held through April 1, 2004 is provided in Table A-1 of Appendix A.

- Environmental Work Group: Addresses issues related to water quality, aquatic and terrestrial resources, fisheries, and geology.
- Recreation and Socioeconomics Work Group: Addresses issues related to recreational facilities, access, use, and socioeconomic issues related to recreation.
- Cultural Resources Work Group: Addresses issues related to historic and prehistoric cultural resources.
- Land Use, Land Management, and Aesthetics Work Group: Addresses issues related to the uses and management of lands within and adjacent to the FERC boundary and issues related to the visual and auditory environment.
- Engineering and Operations Work Group: Addresses issues related to the engineering, operation, and maintenance of the Oroville Facilities; also provides modeling support services to the Collaborative. The Engineering and Operations Work Group has also hosted a series of modeling workshops to describe the modeling efforts under way in support of the Collaborative and the decision-making process.

The work groups developed, and the Plenary Group approved, 71 technical study plans that are currently being undertaken by DWR to address issues identified as important to participants in the Collaborative, to fulfill regulatory requirements, to identify potential impacts, and to identify PM&E measures. The results of these studies will be used in preparing the January 2005 PDEA.

Table 1.4-2. Work group participants.

Environmental Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
• NOAA Fisheries • USFS, Plumas NF • USACE • USFWS	• DFG • DWR • DPR • California Department of Conservation • SWRCB	• Butte County • City of Yuba City • Yuba County Water Agency
Native American Tribes	**State Water Project Contractors**	**Nongovernmental Organizations**
• Enterprise Rancheria	• Various SWCs	• American Rivers • California Waterfowl • Association • Natural Heritage Institute • General public

Table 1.4-2. Work group participants.

Recreation and Socioeconomics Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
∉ U.S. National Park Service ∉ Plumas NF	∉ DFG ∉ DWR ∉ DPR ∉ SWRCB	∉ Butte County ∉ City of Oroville ∉ Feather River Recreation and Park District ∉ Joint Powers Authority ∉ Oroville Chamber of Commerce
Native American Tribes	**State Water Project Contractors**	**Nongovernmental Organizations**
∉ Berry Creek Rancheria of Konkow Maidu Indians ∉ Enterprise Rancheria ∉ Mooretown Rancheria	∉ Various SWCs	∉ American Whitewater/Chico Paddleheads ∉ Berry Creek Citizens Committee ∉ Butte County Tax Payers Association ∉ Butte Sailing Club ∉ Butte County Citizens for Fair Government ∉ Citizens for Fair and Equitable Recreation ∉ California Horsemen's Association—Region II ∉ Equestrian Trail Riders/Hikers ∉ Experimental Aircraft Association, Chapter 1112 ∉ Feather River Low Flow Alliance ∉ Lake Oroville Bicycle Organization ∉ Lime Saddle Marina ∉ Lake Oroville Fish Enhancement Committee (LOFEC) ∉ Oroville Foundation of Flight ∉ Oroville Model Airplane Club ∉ ORAC ∉ Oroville Water Ski Club ∉ Shasta Paddlers ∉ General public
Cultural Resources Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
∉ U.S. Bureau of Indian Affairs ∉ U.S. Bureau of Land Management (BLM) ∉ USFS, Plumas NF	∉ DWR ∉ DPR	∉ Butte County

Table 1.4-2. Work group participants.

Native American Tribes	**State Water Project Contractors**	**Nongovernmental Organizations**
∉ Berry Creek Rancheria of Konkow Maidu Indians ∉ Cherokee Tribe ∉ Konkow Valley Band of Maidu ∉ Enterprise Rancheria ∉ Mechoopda Indian Tribe of Chico Rancheria ∉ Mooretown Rancheria ∉ California Autochthon Peoples Foundation	∉ Various SWCs	∉ Butte County Citizens for Fair Government ∉ California Horsemen's Association—Region II ∉ General public
Land Use, Land Management, and Aesthetics Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
∉ BLM	∉ DFG ∉ DWR ∉ DPR	∉ Butte County
Native American Tribes	**State Water Project Contractors**	**Nongovernmental Organizations**
∉ Enterprise Rancheria	∉ Various SWCs	∉ ORAC ∉ General public
Engineering and Operations Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
∉ NOAA Fisheries ∉ USACE ∉ USFWS	∉ DFG ∉ DWR	∉ Butte County ∉ Butte County Public Works ∉ Butte Water Commission ∉ Plumas County ∉ Sutter County ∉ City of Yuba City ∉ Yuba County Water Agency
State Water Project Contractors	**Nongovernmental Organizations**	
∉ Kern County Water Agency ∉ Metropolitan Water District of Southern California ∉ Western Canal Water District ∉ Various Other SWCs	∉ JEM Farms ∉ Natural Heritage Institute ∉ General public	

<u>Task Forces</u> have been established as needed to undertake specific tasks identified by a work group or the Plenary Group. As part of the task force process, technical specialists and other participants review and discuss specific subjects associated with one or more resources and provide recommendations to the group that established the task force. A task force may complete a specific task over a brief period of time or provide ongoing input to a specific topic. Task forces have been initiated by work groups to, among other things, assist in the development of technical aspects of study plans, develop interim recreation projects, discuss cross-resource issues, and evaluate potential PM&E measures. Task forces that have been initiated by the Plenary Group include one to track model development and another to develop additional language for the process protocols.

Public Information and Participation: Anyone is welcome to attend meetings of the Plenary Group, work groups, or task forces to become better informed regarding the ongoing progress of the Collaborative. Those interested in finding out more about the Collaborative, and potentially participating in Collaborative meetings, should contact Kim Cotto at 916/653-6700.

DWR has established and maintains the following informational resources to facilitate public input to the relicensing process and ensure that relevant information is readily available to all interested parties:

- Both DWR and the Oroville Branch of the Butte County Library have Public Reference File Rooms that contain information on the Oroville Facilities as well as ongoing relicensing activities and correspondence. The rooms can be visited by the public at the following locations and times:

  California Department of Water Resources
  1416 9th Street, Room 525
  Sacramento, CA 95814

  Hours of Operation: Weekdays, Monday through Friday (excluding federal and State holidays), 8 a.m.–5 p.m.

  Oroville Branch of the Butte County Library
  1820 Mitchell Avenue
  Oroville, CA 95966

  Hours of Operation (as of winter 2004):
  Tuesday and Wednesday: 10 a.m.–8 p.m.
  Thursday: 2–6 p.m.
  Friday: 10 a.m.–5 p.m.
  Saturday: noon–4 p.m.

- A relicensing website contains information on the Oroville Facilities as well as ongoing relicensing activities and correspondence and can be accessed at http://orovillerelicensing.water.ca.gov.

- A relicensing newsletter entitled “Oroville Facilities Relicensing News” is distributed periodically to a mailing list of interested parties and provides updated information regarding relicensing activities. To add your name to the mailing list, send an e-mail to orovillep2100@water.ca.gov. The newsletter can also be viewed on the website.

- A relicensing progress report is submitted to FERC every 6 months, as required by the ALP. All 6-month progress reports submitted to date can be viewed on the relicensing website.
- Comments or questions regarding the relicensing process can be addressed by calling a toll-free number (866/820-8198) or sending an e-mail to orovillep2100@water.ca.gov.

1.5 INTERVENTIONS

FERC's notice of filing of the January 2005 PDEA and final License Application will include a statement that organizations and individuals may petition to intervene and become a party to any subsequent proceedings.

1.6 COMPLIANCE

As part of the relicensing process, DWR must document compliance with other federal and State laws that are relevant to its operation of the Oroville Facilities. A summary of relevant federal and State laws and regulations, and the current status of compliance with these requirements, is provided in Table A-3 of Appendix A.

1.7 COMMENTS ON THE DRAFT LICENSE APPLICATION

The draft License Application, including this PDEA Progress Summary, is being circulated for public review and comment. All written comments must be submitted to DWR by 5 p.m. on June 30, 2004, at the following address:

Raphael A. Torres
Executive Manager
Oroville Facilities Relicensing Program
California Department of Water Resources
1416 9th Street
Sacramento, CA 95814

DWR and the Oroville Branch of the Butte County Library will each have a hard copy of the PDEA and access to the Oroville Relicensing website. The locations and hours of operation are listed above under "Public Information and Participation."

This PDEA Progress Summary is available in hard copy or in disk form (CD) by request. The report is also available on the DWR Oroville Relicensing website.

Any comments received during the review period will be taken into consideration by DWR during completion of the environmental analyses and preparation of the final License Application.

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2.0 PURPOSE AND NEED FOR ACTION

2.1 PURPOSE OF THE PROPOSED ACTION

The NEPA Proposed Action to be addressed in the January 2005 PDEA and the FERC EIS or EA is continued operation and maintenance of the Oroville Facilities for electric power generation, including implementation of any terms and conditions to be considered for inclusion in: (1) a new FERC license, and (2) a settlement agreement developed through the collaborative process that are within FERC jurisdiction.

The existing license for the Oroville Facilities (issued by FERC on February 11, 1957) will expire on January 31, 2007. DWR is seeking a new federal license; therefore, the purpose of the Proposed Action is to continue generating electric power while continuing to meet existing commitments and comply with regulations pertaining to water supply, flood control, the environment, and recreational opportunities. The January 2005 PDEA will contain evaluations of the Proposed Action, other “action alternatives” (currently being developed along with the Proposed Action), and a “No Action Alternative.” FERC will use the results of these evaluations to prepare an EA, a Finding of No Significant Impact (FONSI), or a draft and final EIS to support its decision-making under the Federal Power Act (FPA) and other federal laws. When deciding whether to issue a license for a hydroelectric project, FERC also “must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway.” In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation, and water supply), FERC must give equal consideration to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality (FERC 2001).

It is critical that any new license terms and conditions allow DWR to meet all of its commitments related to the Oroville Facilities. These water supply, flood management, and recreation and environmental commitments are defined further in Section 2.3.

2.2 NEED FOR POWER

The continued operation of the Oroville Facilities for electric power generation alleviates the need for new power resources that would otherwise be required to replace the 762 MW of capacity and roughly 2.5 billion kilowatt-hours (kWh) per year of energy generated by the three Oroville power plants. This power capacity and generation is vital to the State of California, in that it provides a large portion of the electricity needed to pump water throughout the State Water Project (SWP) service area at a lower cost than potential replacement power resources. Thus, continued operation of the Oroville Facilities for electric power generation is significant to DWR in achieving its central mission of providing a reliable and affordable supply of water to its water customers.

Power operations of the Oroville Facilities are heavily influenced by SWP-related agreements and other commitments. Continued operation and maintenance of the power features of the Oroville Facilities must be consistent with the operational criteria dictated by the operation of the entire SWP. The operation of the SWP is described in Section 2.3.1.

The Oroville Facilities power plants operate in conjunction with, and are integral to the hourly operation of, other SWP power plants and the Central Valley Project (CVP). The primary operating function of the Oroville Facilities is to provide electricity to SWP pumps that move water through the SWP system. Overall, the SWP uses more energy than it produces. Thus, any decrease in power generation at the Oroville Facilities would need to be offset by increased purchases of energy from other resources and/or by construction of new power generating facilities. In 2000, the SWP required 9,190,000 megawatt-hours (MWh) of generation to meet pumping requirements and station service usage. In the same year, the Oroville Facilities generated roughly 2,760,000 MWh of that total, which amounts to about one-third of the system's total requirements.

By generating hydroelectric power, the Oroville Facilities displace the need for other power plants to operate, thereby avoiding power plant emissions from fossil fuel plants and creating an environmental benefit. Power from the Oroville Facilities contributes to a diversified generation mix and helps meet power needs within and beyond the region. Regional power benefits from the Oroville Facilities include those often referred to as ancillary system benefits, including spinning reserve, peaking capacity, voltage regulation, and grid stability. Additional information regarding power operations and benefits is included in Section 3.4.4.

2.3 DWR OPERATIONS RELATED TO THE OROVILLE FACILITIES

The continued operation and maintenance of the Oroville Facilities for hydroelectric power generation must be consistent with several other important DWR commitments. These commitments include water supply, flood management, and a wide range of recreation and environmental commitments. These commitments are described in more detail in Sections 2.3.1, 2.3.2, and 2.3.3 below.

2.3.1 Water Supply

2.3.1.1 Overview of the State Water Project

The Oroville Facilities were developed as a major part of the SWP, a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to provide a reliable and affordable water supply to urban and agricultural water users throughout California.

In 2000, 4,932,000 acre-feet (af) of water were conveyed to 27 long-term contractors and 17 other agencies. About 23 million of California's estimated 34 million residents directly benefit from SWP water as a domestic water source. These supplies also irrigate nearly 600,000 acres of farmland, mainly in the San Joaquin Valley (DWR 2002).

2.3.1.2 Role of the Oroville Facilities within the State Water Project

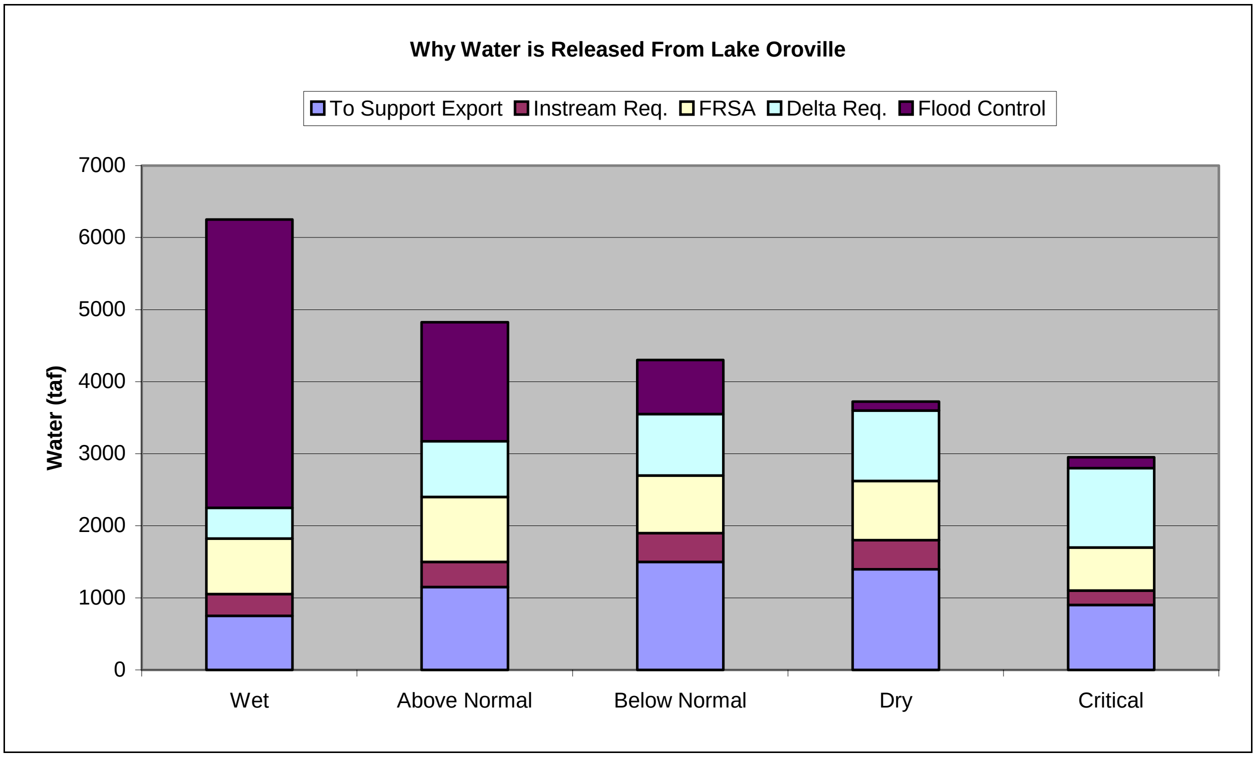
The Oroville Facilities are located at the foot of the Sierra Nevada in Northern California on the Feather River in Oroville, have the capacity to store more than 3.5 million acre-feet (maf) of water, and account for a large portion of the SWP's water capture and storage each year. Water released from the Oroville Facilities into the Feather River flows south into the Sacramento River.

2.3.1.3 Uses of Lake Oroville Water

As shown in Figure 2.3-1, water stored in Lake Oroville is released to meet a variety of contractual, environmental, and flood management commitments:

- Flood management, USACE criteria;
- Contractual water supply amounts for the Feather River Service Area (FRSA);
- Water quality control under SWRCB Decision 1641 (D-1641) and the *1995 Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary* (1995 WQCP);
- Feather River riparian flows;
- Minimum instream flow requirements for the Feather River;
- Water temperature control in the Feather River below Thermalito Afterbay; and
- Water supply for the State Water Contractors (SWC).

The flood control, contractual, environmental, fishery, and water quality obligations are defined in numerous operating agreements that specify timing, flow limits, storage amounts, and/or constraints on water delivery. Contractual requirements are met through scheduled releases of water from various points within the Oroville Facilities, including Lake Oroville, the Thermalito Diversion Dam, Thermalito Afterbay, and the Thermalito Afterbay outlet, which discharges into the Feather River. The scheduling of water releases to meet all of these delivery obligations requires a tremendous amount of planning, forecasting, and interagency coordination among DWR and other agencies. Additional information is included in Section 3.3.2, Project Operations and Maintenance.



taf = thousand acre-feet
Source: DWR.

Figure 2.3-1. Primary Uses of Lake Oroville water.

2.3.2 Flood Management

Oroville Dam provided downstream flood protection even before it was completed. In 1964, while the dam was under construction, it prevented millions of dollars of property damage and saved lives by impounding floodwaters. Today, flood management remains one of the major benefits of this dam. The Oroville Facilities are an integral component of the flood management system for areas along the Feather and Sacramento Rivers downstream of Oroville Dam. They supply flood protection benefits to Oroville, Marysville, Yuba City, many smaller communities, and as far downstream as the Sacramento metropolitan area. The Oroville Facilities also provide protection to about 283,000 acres of highly developed agricultural lands and to main highway and railroad routes. The total value of structures and contents in the areas along the Feather River affected by Oroville Dam is nearly $3 billion (USACE 1999). USACE helped provide funding for the construction of Oroville Dam and has jurisdiction over flood management operations. Additional flood management information and related DWR commitments is included in Section 3.3.2, Project Operations and Maintenance.

2.3.3 Recreation and Environmental

The Oroville Facilities are also operated and maintained to help meet recreation needs, as well as protect and enhance fish and wildlife species and their habitat. This includes operation and maintenance of recreation facilities, operation of the Oroville Wildlife Area (OWA), support for the Feather River Fish Hatchery, and the release of flows into the Feather River that help support fish and aquatic habitat. Many of the recreation and environmental programs implemented within the study area are cooperatively managed or are based on agreements with other agencies (e.g., DFG, DPR).

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3.0 DEVELOPMENT AND DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

3.1 INTRODUCTION

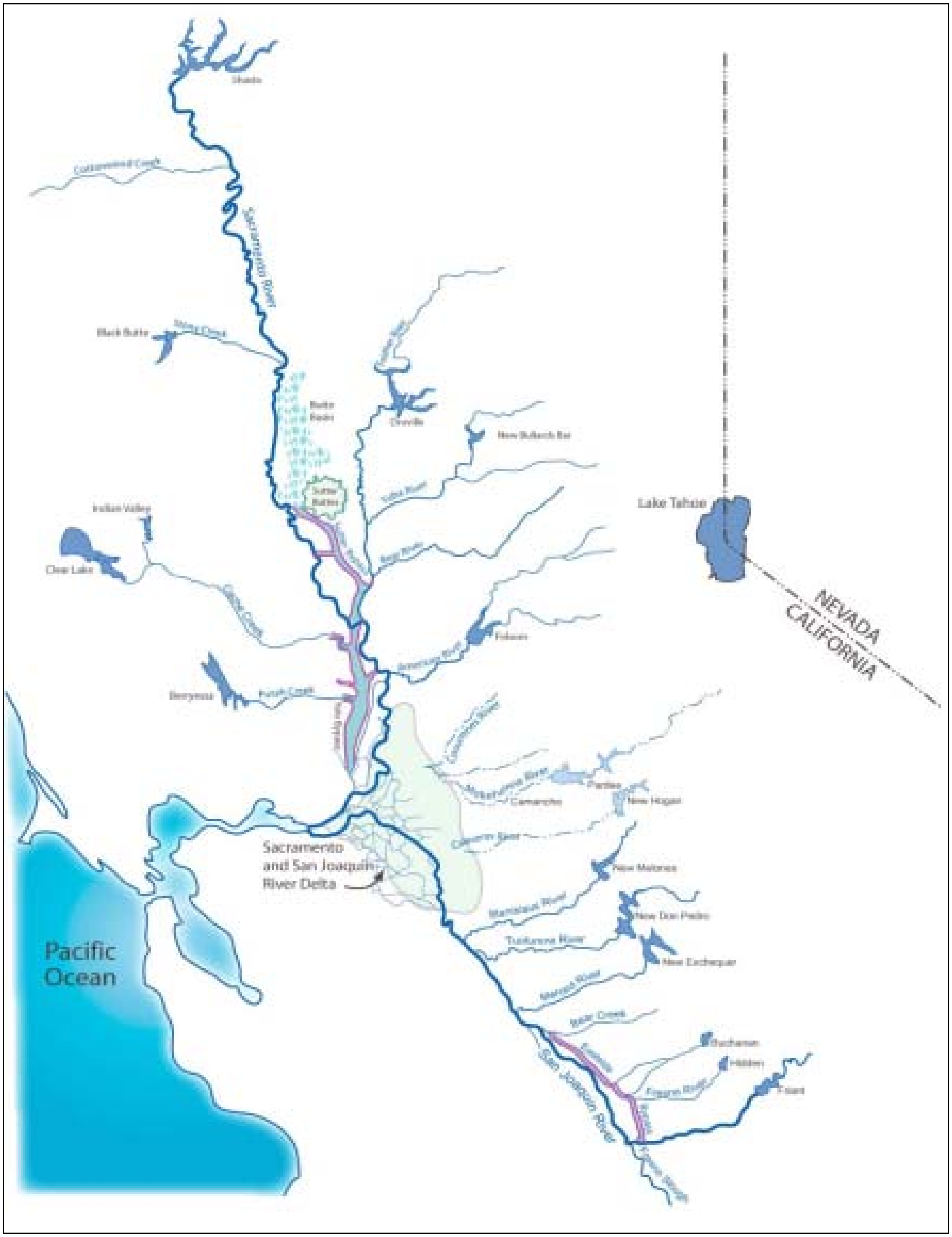
This chapter describes how the Proposed Action and alternatives will be developed for analysis in the January 2005 PDEA. As described in Scoping Document 2, DWR proposes to evaluate three primary alternatives, including the No Action Alternative, in detail in the January 2005 PDEA. (The Proposed Action and other action alternatives are referred to herein as “the primary action alternatives,” while these alternatives plus the No Action Alternative are referred to as “the primary alternatives.”) The chapter begins with a description of the Oroville Facilities, as they currently exist, along with a summary of environmental commitments and programs. An overview of existing environmental conditions is also provided in Section 3.4, Affected Environment.

The current conditions, commitments, and programs of the Oroville Facilities are the starting point for development of the primary alternatives. A description of the No Action Alternative is presented in Section 3.3. The final sections describe how the other primary alternatives would be developed, using information and suggestions derived through the scoping process, as well as various combinations of PM&E measures that have been recommended for consideration by DWR, government agencies, nongovernmental organizations (NGOs), and other stakeholders involved in the collaborative process.

3.2 GENERAL LOCALE

California’s Central Valley includes two major river basins—the Sacramento River on the north, and the San Joaquin River on the south (Figure 3.2-1). The Sacramento and San Joaquin Rivers converge in the Sacramento–San Joaquin Delta (Delta); from there, water from both rivers flows to San Francisco Bay and then to the Pacific Ocean. The Sacramento River contributes approximately 85 percent and the San Joaquin River contributes approximately 10–15 percent of the Delta water inflow in most years.

The Sacramento River basin is composed of the three major sub-basins: the American River sub-basin, the Feather River sub-basin, and the Sacramento River sub-basin. The Feather River sub-basin is composed primarily of the Bear River, Yuba River, and Feather River. The Oroville Facilities are located on the Feather River in the foothills of the Sierra Nevada in Butte County, California. Oroville Dam is located 5 miles east of the City of Oroville and about 130 miles northeast of San Francisco. The Feather River, a major tributary to the Sacramento River, provides about 25 percent of the flow in the Sacramento River as measured at Oroville Dam.



Source: DWR.

Figure 3.2-1. Bay-Delta area map.

The Feather River watershed is located at the north end of the Sierra Nevada. The watershed is bounded by the volcanic Cascade Range to the north, the Great Basin on the east, the Sacramento Valley on the west, and higher elevation portions of the Sierra Nevada on the south. The Feather River watershed upstream of Oroville Dam is approximately 3,600 square miles and comprises approximately 68 percent of the Feather River basin. Downstream of Oroville Dam, the basin extends south and includes the drainage of the Yuba and Bear Rivers. The Yuba River joins the Feather River near the city of Marysville, 39 river miles downstream of Oroville, and the confluence of the Bear River and the Feather River is 55 river miles downstream of Oroville. Approximately 67 miles downstream of Oroville, the Feather River flows into the Sacramento River, near the town of Verona, about 21 river miles upstream of Sacramento. The Feather River watershed, upstream of the confluence of the Sacramento and Feather Rivers, has an area of about 5,900 square miles.

The upper watershed (upstream of Oroville Dam) is ruggedly mountainous, bisected by deep canyons in the western third of the watershed. The central third of the watershed is a transition zone consisting of broad alluvial valleys surrounded and separated by high, steep peaks and ridges. The headwater areas of the eastern third consist of long, broad meadow systems separated by relatively low ridges. Elevations range from 922 feet at the crest of Oroville Dam to more than 10,400 feet at Mount Lassen. The major tributaries as well as the major forks of the Feather River (including the South Fork, East Branch North Fork, North Fork, and Middle Fork) generally flow from east to west.

The North Fork, South Fork, and Middle Fork Feather River are the primary rivers that form the reservoir at Lake Oroville. Before construction of the dam, the Middle and South Forks joined 5.4 river miles above what is now Oroville Dam, and were then joined by the North Fork 3 river miles below their confluence. Their confluence is now Lake Oroville, a 3,540,000-af reservoir that is one component of the Oroville Facilities. About half of the flow into Lake Oroville comes from the North Fork Feather River. The average annual inflow, dependent on annual precipitation, into Lake Oroville is approximately 4 maf. Outflow from the Oroville Facilities typically varies from spring seasonal highs averaging about 8,000 cubic feet per second (cfs) to about 3,500 cfs in November.

Downstream of Oroville Dam, the Feather River can be diverted into the Thermalito Complex and the Feather River Fish Hatchery, and used to maintain instream flows in the low-flow channel of the Feather River. Some of the water diverted to the Thermalito Complex is returned to the Feather River approximately 6 miles downstream of Oroville Dam. The Feather River, downstream of the Thermalito Afterbay outlet and the confluence of the low-flow channel, is generally known as the Lower Feather River. The Lower Feather River flows through a variety of habitat types, agriculture types, and urban areas until its confluence with the Sacramento River. The flows in the Lower Feather River are maintained relatively constant through regulation of the Thermalito Afterbay outlet.

Most of the upper watershed is owned and managed by a variety of federal, State, and local entities, including the USFS, DPR, BLM, DFG, Butte County, and the City of Oroville. Principal land use activities in the region include recreation, agriculture, timber production, hydropower generation, and livestock grazing. More than 70 square miles (or 4 percent of all land) in Butte County is devoted to urban uses. Most of the population is located in several small communities in larger alluvial valleys. The North Fork Feather River canyon serves as a major east-west transportation arterial (Union Pacific Railroad and State Route [SR] 70). The Feather River (principally the North Fork Feather River) has extensive hydropower generation development, producing more than 1,750 MW of electricity. Approximately 45 miles of the Middle Fork Feather River are federally designated as a Wild and Scenic River from Sloat, California, to within 1.5 miles of Lake Oroville.

Climate in the region follows a Mediterranean pattern, with cool wet winters and hot dry summers. Temperatures range from below zero to above 100ºF. Approximately 95 percent of the annual precipitation occurs during the winter months. Precipitation ranges from 33 inches at Oroville, to more than 90 inches at the orographic (i.e., mountain) crest near Bucks Lake, to less than 20 inches in the eastern headwaters. Precipitation above 5,000 feet occurs primarily as snow, which regularly accumulates in excess of 5–10 feet in winter. There are infrequent summer thunderstorms, predominantly in the eastern third of the watershed. These storms can produce significant rainfall of short duration over a relatively small area.

The mean annual discharge of the Oroville Facilities into the Feather River is in excess of 2.7 maf. These waters are used for a variety of beneficial uses including recreation, coldwater aquatic habitat, hydropower generation, irrigation, and domestic and municipal water supply. The Oroville Facilities are a critical part of the SWP, providing much of the system’s water collection and storage, flood control, and power production capacity.

3.3 THE NO ACTION ALTERNATIVE: CONTINUED OPERATION AND MAINTENANCE OF EXISTING FACILITIES UNDER THE EXISTING LICENSE AND RELATED AGREEMENTS

NEPA requires the evaluation of the “No Action” Alternative, against which the effects of the “action alternatives” can be compared. The purpose of describing and analyzing a No Action Alternative is to allow decision-makers to better understand the environmental consequences of continuing to operate a project under the terms and conditions of its existing FERC license. Such consequences can then be compared to those associated with the primary action alternatives, which are expected to include new PM&E measures that would require modifications to the existing license terms and conditions.

Under the No Action Alternative, the Oroville Facilities would continue to be operated as they are now under the terms and conditions in the existing FERC license, and no new

PM&E measures would be implemented other than those arising from existing legal obligations. These terms and conditions, along with other agreements and permits that DWR is committed to maintaining and implementing, including environmental programs, are also referred to as existing DWR's commitments. In addition, DWR would continue existing maintenance practices needed to maintain the Oroville Facilities. This definition of No Action conditions is consistent with the guidance contained in the following:

- Council on Environmental Quality (CEQ) NEPA guidance (see question 3 in the CEQ's "Forty Most Asked Questions Concerning CEQ's NEPA Regulations," 46 Federal Register [FR] 18026, March 23, 1981, and as amended, 51 FR 15618, April 25, 1986); and
- FERC guidance on preparing PDEAs (FERC 2001).

This chapter describes the elements of the No Action Alternative, including the key conditions of the existing FERC license, environmental commitments, recreation programs, and other agreements that affect current Oroville Facilities operations. These conditions and commitments would continue to affect operations in the future under the No Action Alternative.

A complete assessment of the effects of the No Action Alternative will be included in the January 2005 PDEA. These effects would include continuation of the ongoing effects of the Oroville Facilities, along with other effects that would occur over time if the Proposed Action or any of the other primary action alternatives are not implemented. The No Action Alternative impact assessment will use the CALSIM II, HYDROPS, WQRRS, and other modeling and technical studies being completed for the "benchmark" modeling scenarios being used to simulate existing conditions and future conditions. These scenarios and related modeling results are being completed for the January 2005 PDEA with input provided by stakeholders at the related and ongoing modeling workshops.

3.3.1 Oroville Facilities Description

This section presents an overview of the Oroville Facilities. A detailed description of the facilities is presented in Appendix B.

The Oroville Facilities (Figure 3.3-1) were developed as part of the SWP and are located at the foot of the Sierra Nevada in Northern California on the Feather River in Oroville. Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a reservoir with storage capacity of more than 3.5 maf and a surface area of 15,810 acres at its normal maximum operating level of 900 feet above mean sea level (msl). The Oroville Facilities are operated for water supply, power, flood management, recreation, and enhancement of fish, wildlife, and their habitat.

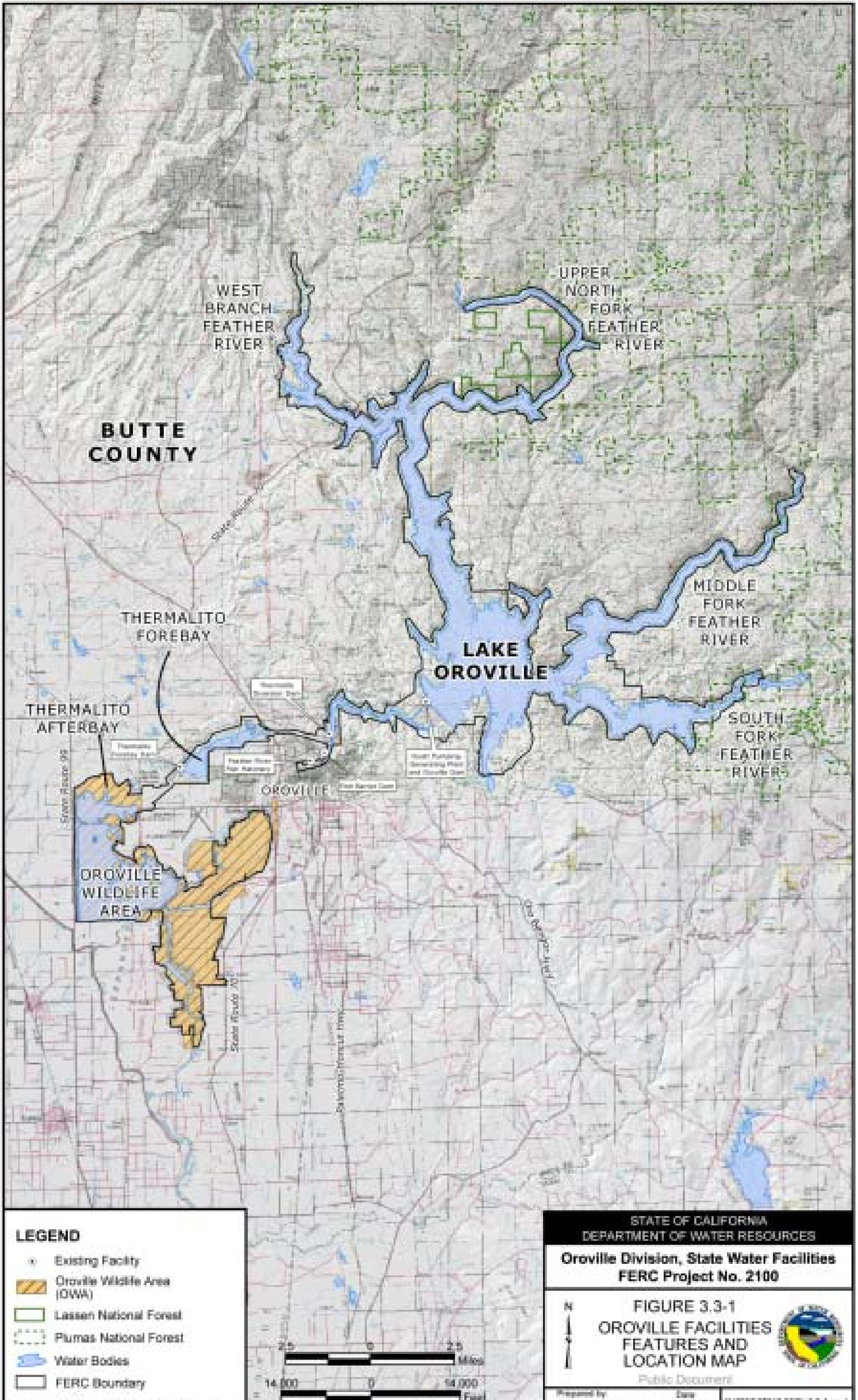
Operation of the SWP required more than 9.19 billion kWh of electricity in 2000 to pump deliveries of 4.9 maf of water. The electric power needs of the SWP are met, in part, by the output of the three power plants that are a part of the Oroville Facilities (DWR 2002).

FERC Project No. 2100 encompasses 41,100 acres and includes all of the following:

- Oroville Dam;
- Lake Oroville;
- Three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant);
- Thermalito Diversion Dam;
- The Feather River Fish Hatchery;
- The Fish Barrier Dam;
- Thermalito Power Canal;
- OWA;
- Thermalito Forebay;
- Thermalito Forebay Dam;
- Thermalito Afterbay;
- Thermalito Afterbay Dam;
- Transmission lines and switchyards; and
- A relatively large number of recreational facilities.

The hydroelectric units at the Oroville Facilities have a combined license generating capacity of approximately 762 MW. The Hyatt Pumping-Generating Plant is the largest of the three power plants with a capacity of 645 MW. Water from the six-unit underground power plant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of Oroville Dam. The plant has generating and pumping flow capacities of 16,950 cfs and 5,610 cfs, respectively. Other generation facilities include the 3-MW Thermalito Diversion Dam Power Plant and the 114-MW Thermalito Pumping-Generating Plant.

Thermalito Diversion Dam, 4 miles downstream of Oroville Dam, creates a tailwater pool for the Hyatt Pumping-Generating Plant and is used to divert water to the Thermalito Power Canal. The Thermalito Diversion Dam Power Plant is a 3-MW power plant located on the left abutment of the diversion dam. The power plant releases a maximum of 615 cfs of water into the river.


WEST BRANCH FEATHER RIVER
UPPER NORTH FORK FEATHER RIVER
BUTTE COUNTY
State Route 70
MIDDLE FORK FEATHER RIVER
LAKE OROVILLE
THERMALITO FOREBAY
THERMALITO AFTERBAY
SOUTH FORK FEATHER RIVER
OROVILLE
OROVILLE WILDLIFE AREA
State Route 99
State Route 70
LEGEND
Existing Facility
Oroville Wildlife Area (OWA)
Lassen National Forest
Plumas National Forest
Water Bodies
FERC Boundary
Sources: DWR 2003, USFS 2003, EDAW 2003
2.5
0
2.5
Miles
14,000
0
14,000
Feet
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
N
FIGURE 3.3-1
OROVILLE FACILITIES FEATURES AND LOCATION MAP
Public Document
Prepared by: EDAW (LC)
Date: 4-21-04

The Thermalito Power Canal is a 10,000-foot-long channel designed to convey generating flows of up to 16,900 cfs to Thermalito Forebay and pump-back flows to the Hyatt Pumping-Generating Plant. Thermalito Forebay is an offstream regulating reservoir for the 114-MW Thermalito Pumping-Generating Plant. The Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and has generating and pump-back flow capacities of 17,400 cfs and 9,120 cfs, respectively. When in generating mode, the Thermalito Pumping-Generating Plant discharges into Thermalito Afterbay, which is contained by a 42,000-foot-long earthfill dam. The afterbay is used to release water into the Feather River downstream of the Oroville Facilities and helps regulate the power system, provides storage for pump-back operations, and provides recreational opportunities. Several local irrigation districts receive water from Thermalito Afterbay.

The Fish Barrier Dam is downstream of Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the Thermalito Afterbay outlet, and provides attraction flow for the hatchery. The hatchery is designed to compensate for the loss of spawning grounds and rearing areas for returning salmon and steelhead trout and their offspring as a result of construction of Oroville Dam. The hatchery has recently accommodated more than 20,000 adult fish and 15 million young fish annually.

The Oroville Facilities support a wide variety of recreational opportunities. These opportunities include boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, and hunting. There are also visitor information sites with cultural and informational displays about the developed facilities and the natural environment. There are major recreation facilities at Loafer Creek, Bidwell Canyon, Spillway, North and South Thermalito Forebay, and Lime Saddle. Lake Oroville has two full-service marinas, five car-top boat ramps, ten floating campsites, and seven dispersed floating toilets. There are also recreation facilities at the Lake Oroville Visitors Center and OWA.

OWA comprises approximately 11,000 acres west of Oroville that are managed for wildlife habitat and recreational activities. It includes Thermalito Afterbay and surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000-acre area straddles 12 miles of the Feather River, which includes willow and cottonwood–bordered ponds, islands, and channels. Recreation areas include dispersed recreation (hunting, fishing, and bird watching), plus recreation at developed sites, including Monument Hill Day Use Area (DUA), model airplane grounds, three boat launches on the afterbay and two on the river, and two primitive camping areas. A DFG habitat enhancement program includes a wood duck nest-box program and dryland farming for nesting cover and improved wildlife forage. Limited gravel extraction also occurs in a number of locations.

3.3.2 Project Operations and Maintenance

This section describes the current operations and maintenance activities associated with the Oroville Facilities that would continue under the No Action Alternative. A description of operations planning is provided in Section 3.3.2.1, followed by a discussion of current operations that is divided into four components:

- Water supply (Section 3.3.2.2);
- Flood management (Section 3.3.2.3);
- Power (Section 3.3.2.4); and
- Recreation and environmental commitments and programs (Section 3.3.2.5).

In addition to the specific types of project operations discussed in the sections below, various routine operation and maintenance (O&M) activities are ongoing and would continue under the No Action Alternative. These activities, which include routine repairs and maintenance, seismic monitoring, and tests and inspections, are intended to meet the following objectives:

- Ensure efficiency and reliability of operation;
- Meet Feather River Service Area (FRSA) contractual obligations;
- Meet flood control commitments, and
- Implement water conservation practices.

Typical O&M activities conducted at the Oroville Facilities are listed in Table 3.3-1.

Table 3.3-1. Typical O&M activities at the Oroville Facilities.

Type of Activity	Typical Activities*
Seismic Monitoring	• Conduct surveys to monitor vertical and horizontal movement and lateral displacement of dams, structures, plants, and appurtenant features. • Provide project surveillance and instrumentation to monitor structural integrity of dams, structures, plants, and appurtenant features. • Operate and maintain strong-motion accelerographs installed in and on DWR structures. • Maintain, record, and analyze data for a Statewide telemetered array of seismographic stations. • Report earthquakes of magnitude 3.7 and greater to the Division of Safety of Dams (DSOD) or DWR. • Prepare seismicity report every 5 years to note trends that could affect project facilities.

Table 3.3-1. Typical O&M activities at the Oroville Facilities.

Type of Activity	Typical Activities*
Routine Repairs and Maintenance	∉ Perform routine maintenance and repair to outlet structures, release facilities, valving, piping, slide gates, radial gates, controls/load centers, transformers, and cranes. ∉ Perform routine and annual maintenance and repairs to electrical, mechanical, and control systems equipment at the Hyatt Pumping-Generating Plant and Hyatt Intake Shutters, the Thermalito Pumping-Generating Plant, and the Thermalito Diversion Dam Power Plant. ∉ Seal and repair masonry structures to avoid foundation failures. ∉ Remove debris and repair erosion from overchute, underdrains, intake, and discharge channels to promote cross drainage. ∉ Sandblast, repair, and recoat stop logs, rusted parts, and radial gates. ∉ Perform routine maintenance and repair to fish facilities; pumps; motors; load centers; control centers; standby engine generators; lighting; ultraviolet facilities; valving; piping; gear operators; water chillers; heating, ventilation, and air conditioning (HVAC) systems; and all equipment exceeding 480 volts. ∉ Repair roads and rights-of-way, embankments, dams, hydraulic structures, the Feather River Fish Hatchery, protected devices, gates, signs, bridges, and fences.
Monitoring, Tests, and Inspections	∉ Perform roof inspections and normal maintenance of buildings (including janitorial services), landscaping, and bike trails. ∉ Repaint interior and exterior of plants and buildings. ∉ Monitor water quality by conducting water quality testing. ∉ Monitor levels of combustible gases dissolved in transformer insulating oil and metals in lubricating oil. ∉ Develop and implement annual Pest Management Program and conduct routine inspections to ensure structural integrity and efficient water operations. ∉ Conduct high-voltage insulation testing of stator windings, power transformers, busings, oil, coupling capacitors, surge arresters, circuit breakers, and voltage and current transformers.
Other Activities	∉ Perform flow, pressure, strain, vibration, timing, and other specialized tests as needed to diagnose and correct operations, maintenance, and other problems associated with plant apparatus and systems. ∉ Provide preventive, proactive, and reactive electrical and mechanical maintenance on pumping plants, switchyards, and surge tanks. ∉ Provide 24-hour shift coverage of power plant operations. ∉ Install stop logs and scaffolding for removal of pumps and valves in pumping plants. ∉ Convey water from Lake Oroville through Thermalito Forebay and Thermalito Afterbay for local distribution and to meet downstream requirements. ∉ Store Feather River water in Lake Oroville to meet downstream requirements and to satisfy flood control requirements. ∉ Collect data and provide input to the DWR Cooperative Snow Survey program and provide water measurement of inflow to Lake Oroville and downstream

Table 3.3-1. Typical O&M activities at the Oroville Facilities.

Type of Activity	Typical Activities*
	releases. ∉ Clear and dispose of debris on Lake Oroville. ∉ Operate and perform minor maintenance on light and heavy mobile equipment. ∉ Conduct studies pertaining to emergency operations and hazardous materials management to improve operation and maintenance of facilities. ∉ Perform herbicide and insecticide spraying.

** These are standard O&M activities that are usually performed annually, but not in all cases.*
Source: Information provided by DWR.

3.3.2.1 Current Project Operations Planning

Operations of the Oroville Facilities are planned and scheduled in concert with other SWP facilities and the U.S. Bureau of Reclamation (USBR) CVP through the Coordinated Operations Agreement (COA). Water stored and released from Lake Oroville is managed to meet local and downstream water supply and environmental demands when unregulated flows are not enough to satisfy those needs. The Oroville Facilities also play an important role in protecting lives and property downstream along the Feather and Sacramento Rivers during periods of high flows. In addition, the operation of the Oroville Facilities enables DWR to generate hydroelectric power to offset SWP pumping power purchase requirements.

Operation of the Oroville Facilities varies seasonally, weekly, and hourly, depending on hydrology and the objectives DWR is trying to meet. Typically, releases to the Feather River are managed to conserve water while meeting instream flow, temperature, fisheries, recreation, water quality, diversion, Delta, and SWP flow requirements.

Operations scheduling is accomplished through long-term, strategic, and tactical plans. The long-term plans for reservoir releases account for the overall objectives of the SWP, while meeting other water supply commitments in the Feather River and downstream. On an annual basis, the reservoir storage of approximately 3.5 maf is used to satisfy a number of commitments. Generally, the reservoir will be drawn down to meet local contractual water supply demands, provide for environmental objectives in the Delta, allow for delivery of water to the SWP, and provide storage of water for future years.

The overall operations plan for the Oroville Facilities is updated regularly to reflect changes in hydrology and downstream conditions. On a weekly basis, releases from Lake Oroville are planned to accommodate the water supply requirements of local water users, Delta water quality, Feather River instream flow, water supply to the SWC, and minimum flood management space. The weekly plan is updated as needed to respond to changing conditions, particularly water quality conditions in the Delta. Daily planning is used to take the status of annual and weekly planning into account, and to allocate power generation within other commitments.

Annual Operations Planning

Operations planning requires coordination with other federal, State, and local agencies, and must consider a number of factors. The Operations Control Office (OCO) develops an annual operations plan that considers forecasted water supply; projected operations of the CVP; regulatory requirements (flood management, instream requirements, and water quality); and contractual obligations. This first official plan for the next year is completed in early December as part of the water allocation planning process and is a significant component in determining the amount of forecasted deliveries to the SWC. This monthly time-step plan includes projected release to the Feather River, forecasts of Oroville inflow, Lake Oroville end-of-month storage levels, and local demands.

The average annual unimpaired flow of the Feather River at Oroville is 5,800 cfs, and annual inflow to Lake Oroville after upstream diversions is approximately 4.0 maf. Lake Oroville is typically filled to its maximum level at elevation 900 feet in June of each year and is then lowered to its minimum level in December or January as necessary to meet downstream requirements. During drier years, the reservoir may be drawn down more and may not fill to the desired level the following spring.

As part of the water allocation planning process, not all of the forecasted Oroville storage is used during the current year's operation. It is assumed that only half of the available Lake Oroville storage above the minimum pool is used, and the remaining half is stored for use in subsequent years. This ensures that there will be water to meet the operational needs in case of consecutive dry years.

Weekly Operations Planning

Each week, the OCO develops a general plan for reservoir releases. This plan considers how much water will be needed downstream for: (1) local water supply demands; (2) Delta water quality and quantity requirements; (4) instream flow and temperature requirements; (4) SWP water user demands; and (5) minimum flood management storage space. The weekly plan is revised as needed to meet changing operational conditions both upstream and downstream.

Daily Operations Scheduling

Hourly releases through the power plants are scheduled daily. The hourly operation of the power plants is planned to maximize the amount of energy that may be produced during periods when electrical demand is highest. Additionally, ancillary services required for participation in the electric utility market and to bid into the California Independent System Operator (ISO) are also scheduled on an hourly basis. These ancillary services include spinning reserve, supplemental energy market, and voltage regulation. The hourly schedule may be manipulated to maximize power benefits as long as plant operations fit within the constraints of the overall daily Feather River release objective downstream of Thermalito Afterbay.

3.3.2.2 Water Supply Operations

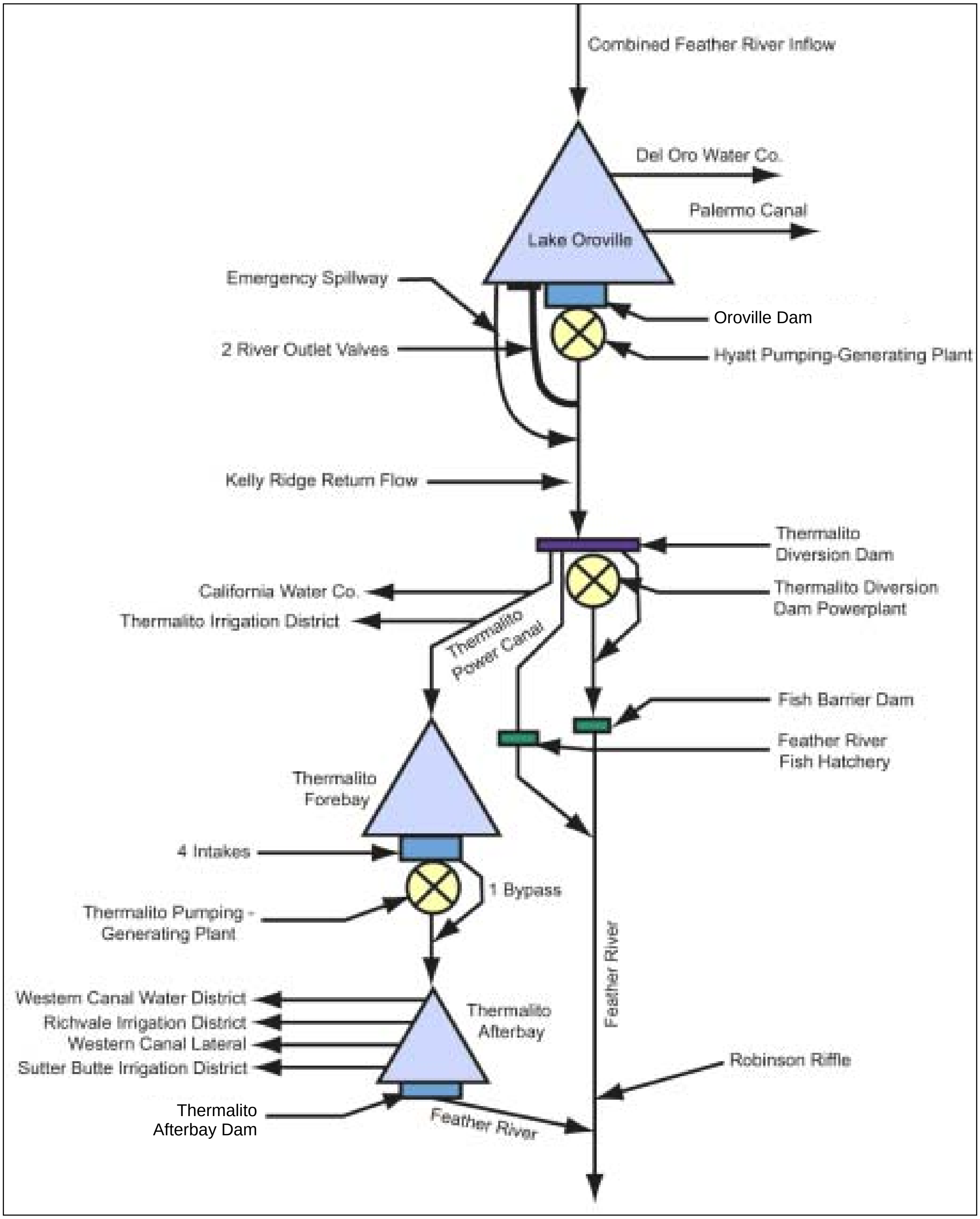
Feather River Service Area Water Supply Obligations

DWR has contractual obligations to nine local agencies[1] in the FRSA that are collectively referred to as the FRSA water users. They receive water according to the terms of settlement in various agreements stemming from the original construction of the project. These settlements recognized the senior water rights of those agencies and determined that DWR would provide them certain quantities of water from storage in Lake Oroville in accordance with those senior water rights. The amount of water DWR is committed to provide these agencies is approximately 994,000 af annually, subject to provisions for reduction in supply under certain specific low-inflow conditions.[2] Water needed to meet these FRSA demands is delivered at two locations in Lake Oroville, two locations in the Thermalito Power Canal, four locations in Thermalito Afterbay, and four locations on the Feather River below Thermalito Afterbay. Figure 3.3-2 is a preliminary schematic diagram depicting physical project features and local diversions; this figure will be modified and updated as appropriate for the January 2005 PDEA.

DWR has also executed a number of small contracts with riparian landowners along the Feather River downstream of Oroville. Riparian owners are entitled to divert unimpaired flow for use on riparian land, but are not entitled to augmented flow made available as a result of project storage. Although the quantities of water are relatively small and do not ordinarily influence SWP operations, in certain years riparian diversions can affect Oroville releases.

[1] The FRSA agencies include the Last Chance Creek Water District; the Thermalito Irrigation District; the Feather River Water and Power (formerly OWID); the Western Canal Water District; the Joint Water District Board (comprising the Richvale Irrigation District, the Biggs-West Gridley Water District, the Butte Water District, and the Sutter Extension Water District); the Tudor Mutual Water Company; the Oswald Water District; the Garden Highway Water Company; and the Plumas Mutual Water Company. The settlement of water rights for these entities is typically expressed in terms of af of annual entitlement, although some settlement agreements also stipulate specific rates of flow in cfs.

[2] Individual contracts with these agencies determine the terms of flow reduction. Of the total entitlement, 187,245 af is not subject to reduction.



Source: DWR.

Figure 3.3-2. Oroville Facilities flow operation diagram.

Water Supply Requirements of the State Water Contractors

As a component of the SWP, the Oroville Facilities are operated to provide downstream water supply for municipal, industrial, and irrigation purposes, and water is exported to meet the requirements of the SWC. To illustrate how water releases from the Oroville Facilities are distributed for multiple downstream uses, Table 3.3-2 shows DWR records from 2001 and 2002 indicating actual releases for various uses. As a practical matter, the export water supply objectives are met with whatever water is available after Delta requirements are met. In other words, some of the water released for instream and Delta requirements in the table below may be available for export by the SWP for SWC use once the Delta standards have been met.

Table 3.3-2. Downstream use of water from the Oroville Facilities (2001 and 2002).

Downstream Use	2001		2002	
	Amount Used (taf)	Percentage of Release	Amount Used (taf)	Percentage of Release
Feather River Service Area	1,024	46	925	34
Support of Exports	93	4	773	28
Instream and Delta Requirements	1,099	50	1,043	38
Flood Control	0	0	0	0
Total	2,216	100	2,741	100

Source: DWR SWP Operations Control Office.
NOTE: taf = thousand acre-feet

Water Quality Control under the *1995 Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary*

Releases are made from Lake Oroville first to satisfy the contractual water supply commitments to the FRSA, and then to provide flows for SWP obligations to support the SWRCB 1995 Water Quality Control Plan (WQCP) before being exported from the Delta to meet the requests of the SWC. The SWP is operated in coordination with the federal CVP to balance water supply and environmental programs, especially in the Delta. Discharges from Lake Oroville contribute to the inflow to the Delta along with other sources, including a number of State, utility, and federal reservoirs.

The Delta comprises a complex network of river channels, levees, gates, and canals that convey inflow from the Sacramento and San Joaquin Rivers and eastside tributaries into San Francisco Bay (see Figure 3.2-1 in Section 3.2).

Current water quality standards for the Delta were established in May 1995 by the SWRCB in the WQCP. Decision 1641 (D-1641) was issued by the SWRCB on March 15, 2000, to implement the 1995 WQCP, which includes objectives for municipal, industrial, agricultural, and fish and wildlife beneficial uses. The 1995 WQCP includes and defines the following objectives designed to benefit fish and wildlife resources:

- *A dissolved oxygen objective* to protect fall-run salmon migrations in the lower San Joaquin River;
- *Salinity objectives for the lower San Joaquin River* to protect spawning by striped bass;
- *Salinity objectives for managed portions of Suisun Marsh* to protect vegetation from excessive salinity in channels and soil water;
- *Delta outflow objectives* to protect estuarine habitat for anadromous fishes and other estuarine-dependent species;
- *Sacramento and San Joaquin River flow objectives* to provide attraction and transport flows and suitable habitat for various life stages of aquatic organisms, including Delta smelt and Chinook salmon;
- *An objective for reducing entrainment* (incidental trapping) of various life stages by the export pumps in the southern Delta; and
- *An objective for closure of the Delta Cross Channel* to reduce the diversion of aquatic organisms into the interior Delta, where such organisms are more vulnerable to entrainment by the major export pumps and local agricultural diversions.

The CVP and SWP are operated in compliance with the requirements of various Biological Opinions (BOs) issued by the USFWS and NOAA Fisheries to protect special-status species and designated critical habitats for winter-run Chinook salmon (federally listed as Endangered); Delta smelt, Central Valley steelhead, and Central Valley spring-run Chinook salmon (federally listed as Threatened); and Sacramento splittail (recently removed from federal proposed listing as Threatened, September 2003). The SWP and CVP meet their water supply obligations by exporting water from the Delta through pumping operations only after the requirements of D-1641 for species and habitat protection are met within the Delta. Operations of SWP facilities (including the Oroville Facilities) and CVP facilities in the Sacramento and San Joaquin Rivers are subject to the following limitations imposed by D-1641:

- A limit on combined SWP and CVP exports of 1,500 cfs between mid-April and mid-May;
- A limit on combined SWP and CVP exports of 35 percent of inflows between February and June, and 65 percent of inflows from July through January;
- Minimum outflow from the Delta of 3,000–8,000 cfs from July through January, depending on the relative normalcy of the water year;
- Outflow from the Delta for habitat protection of 7,100–29,200 cfs from February through June;
- A specific salinity starting condition at Collinsville in February;

- A minimum flow at Rio Vista on the Sacramento River of 3,000–4,500 cfs from September through December, depending on the relative normalcy of the water year;
- A minimum flow at Vernalis on the San Joaquin River of 710–3,420 cfs from February through mid-April and May 16 through June, depending on the relative normalcy of the water year and the location of X2;
- A pulse flow at Vernalis of 3,110–8,620 cfs between mid-April and mid-May, and as much as 28 taf during October, depending on the relative normalcy of the water year and the location of X2; and
- Closure of the Delta Cross Channel gates between February and late May, with provisions for intermittent closure between May 21 through June 15, and conditional closure for November through January.

3.3.2.3 Flood Management Operations

DWR is required by an agreement with the U.S. Army Corps of Engineers (USACE) to operate the Oroville Facilities to manage floodflows in the Feather and Sacramento Rivers. The goal of operations for flood management is to prevent flows in the Feather River at Oroville from exceeding 150,000 cfs. Oroville Dam and Lake Oroville are to be operated in conformance with the flood management regulations prescribed by the Secretary of the Army under the provisions of an Act of Congress (58 Stat. 890; 33 United States Code [USC] 709). Under those regulations, Lake Oroville is to be operated during the winter months to maintain up to 750 taf of storage space to capture significant inflows from runoff and snowmelt.

Flood management operations are summarized below.

- *September 1–October 15:* During this period, the maximum allowable storage decreases to prepare for the flood season.
- *October 15–March 31:* During this period, the maximum allowable storage limit varies from about 2.8 maf (with 750 taf flood storage space) to 3.2 maf (with 375 taf flood storage space) to provide adequate storage space for inflows. These storage capacities correspond to reservoir elevations of 850 feet and 875 feet, respectively. The actual storage limit is based on a wetness index, computed from accumulated basin precipitation, that allows DWR to maintain Lake Oroville at a higher level when the prevailing hydrology is dry, but requires lower levels when the prevailing hydrology is wet.
- *April 1–June 30:* The maximum allowable storage limit is increased during this period as the potential for flooding decreases, allowing DWR to capture higher spring flows for use later in the year. These limits are illustrated in Figure 3.3-3. The flood control diagram is designed for multiple uses of reservoir space. When

flood control space is not required to accomplish flood control objectives, reservoir space can be used for storing water.

During flood events, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River. Table 3.3-3 lists the maximum allowable flows at various locations along the Feather River.

Table 3.3-3. Maximum Feather River flow rates.

Location	Maximum Allowable Flow
Below Lake Oroville	150,000 cfs
Above the Yuba River	180,000 cfs
Below the Yuba River	300,000 cfs
Below the Bear River	320,000 cfs

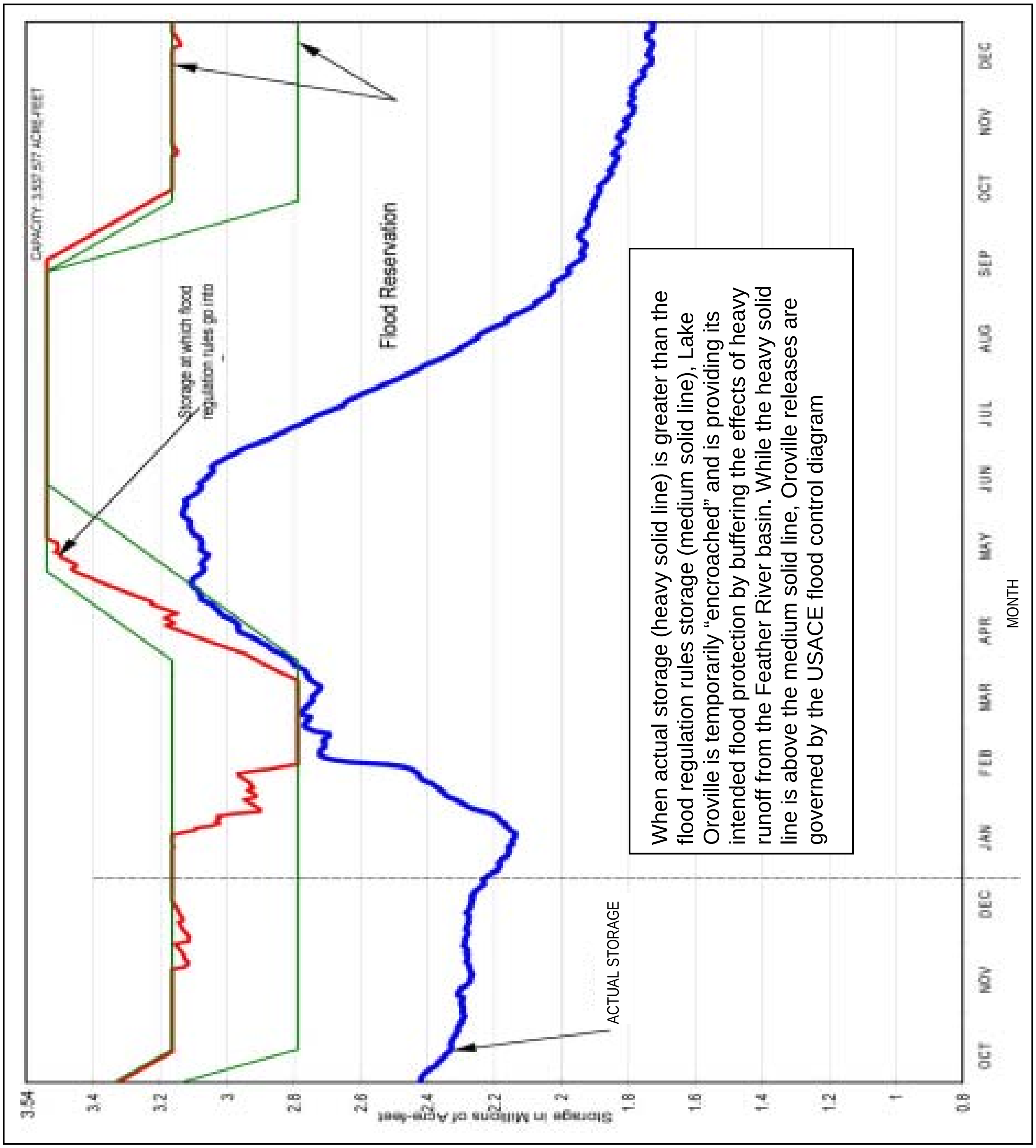
Source: USACE 1970.

The Oroville Facilities are operated to minimize spill, but spill can occur under certain wet hydrologic conditions. Table 3.3-4 lists the significant spills of record. During the storm event of early January 1997, the greatest flood of record since the construction of Oroville Dam, the estimated peak downstream release was 160,000 cfs. This peak release occurred only for a short time. The peak storm inflow to Lake Oroville was 302,000 cfs. In the February 1986 storm event, peak inflow to Lake Oroville was about 266,000 cfs with a maximum release from the Oroville Facilities of 150,000 cfs.

Table 3.3-4. Significant spills of record from Lake Oroville.

Spill Begin Date	Spill Ending Date	Duration of Spill (Days)	Maximum Release (x 1,000 cfs)	Total Volume Over Spillway (x 1,000 af)	Maximum Inflow (x 1,000 cfs)
1/13/70	2/2/70	21 days	77	1,563	147
1/12/80	1/20/80	9 days	85	726	155
2/15/86	3/1/86	15 days	150	1,420	266
3/9/95	3/27/95	19 days	87	1,235	141
12/27/96	1/17/97	22 days	160	2,013	302

Source: Memo from Maurice Roos to Lori Brown dated 7/18/03.



Source: DWR SWP Operations Control Office.

Figure 3.3-3. Lake Oroville storage—October 1, 1999, through December 31, 2000.

Most of the spills shown in the table occurred over the Oroville Dam spillway, but some releases were made through the Hyatt Pumping-Generating Plant. The spillway volume shown in the table does not include flow through the Hyatt Pumping-Generating Plant. The maximum release is the total release to the river, including flow from the Thermalito Afterbay outlet.

3.3.2.4 Power Operations

Power Generation

The Oroville Facilities generate hydroelectric energy and provide other important ancillary electrical system benefits, including spinning reserve, peaking capacity, voltage regulation, and grid stability. While the energy generated from the Oroville Facilities is used to help offset SWP energy needs, almost all of the energy is delivered to the State power grid for dispatch by the California ISO, satisfying about 2 percent of the Statewide peak load demands. With the exception of pump-back generation and daily peaking generation, production of energy is governed by water releases from Lake Oroville for flood management, environmental commitments, water quality, and water supply operations discussed above.

Hydroelectric energy is produced at three generating facilities within the Oroville Facilities: the Hyatt Pumping-Generating Plant, the Thermalito Diversion Dam Power Plant, and the Thermalito Pumping-Generating Plant. When water is withdrawn from Lake Oroville, it passes first through the Hyatt Pumping-Generating Plant, with a capacity of 645 MW, and then into the Thermalito Diversion Pool. Three of the six turbines in the Hyatt Pumping-Generating Plant are capable of pumping water back into Lake Oroville. The plant has a hydraulic generating capacity of 16,950 cfs and a pumping capacity of 5,610 cfs. In a median water year, the Hyatt Pumping-Generating Plant, together with the Thermalito Pumping-Generating Plant, produces an average of 2,200,000 megawatt-hours (MWh) of energy with water released from Lake Oroville. In generating mode, the Thermalito Pumping-Generating Plant has a hydraulic capacity of 17,400 cfs and a generating capacity of 114 MW. In pumping mode, the plant has a capacity of 9,120 cfs.

Operations of the Hyatt Pumping-Generating Plant, Thermalito Diversion Pool, Thermalito Pumping-Generating Plant, Thermalito Power Canal, Thermalito Forebay, and Thermalito Afterbay are summarized below.

<u>Hyatt Pumping-Generating Plant</u>

- Daily changes in Lake Oroville elevation as a result of Hyatt generation, and pumping operations are normally on the order of 6 inches per day. In practice, during the times of highest power generation peaking operation (July–September), the reservoir elevation decreases by up to about 2 feet per day.

- The 645-MW Hyatt Pumping-Generating Plant can discharge up to 16,950 cfs when generating with all 6 units, and can return up to 5,610 cfs when pumping with the 3 units capable of pump-back.
- Flows are normally scheduled on a daily and hourly basis for maximizing generation during on-peak hours when power values are highest, subject to weekly operation plans for project releases from Thermalito Afterbay.
- Pump-back normally occurs during off-peak hours on weekdays and on weekends.
- Flow releases from Lake Oroville require about 3–5 days to travel through the Feather River and Sacramento River, and into the Delta.

Thermalito Diversion Pool

- The pool elevation developed by the Thermalito Diversion Dam remains fairly constant throughout the year and is most susceptible to change when Lake Oroville is spilling.
- The pool acts as an afterbay when the Hyatt Pumping-Generating Plant is generating, and as a forebay when it is pumping.
- The pool also acts as a forebay for water supply to the Feather River Fish Hatchery and the Thermalito Diversion Dam Power Plant, discharging into the Feather River.
- Changes in the Thermalito Diversion Pool elevation are minimal, and normally vary within a range of 222.5 feet to 224.5 feet for a total of about 2 feet (not accounting for spill conditions).

Thermalito Pumping-Generating Plant

- The 114-MW Thermalito Pumping-Generating Plant can discharge up to 17,400 cfs when generating with all 4 units and can return up to 9,120 cfs when pumping with the 3 units capable of pump-back.
- Flows are scheduled on a daily and hourly basis for maximizing generation during weekday on-peak hours when power values are highest, subject to weekly operation plans for project releases from Thermalito Afterbay.
- Pumping normally occurs during off-peak hours on weekdays and on weekends.

The Thermalito Diversion Dam, 4 miles downstream of Oroville Dam, diverts water to the Thermalito Power Canal. The Thermalito Diversion Dam Power Plant is located on the left abutment of the dam and has a generating capacity of 3 MW. This power plant releases a maximum of 615 cfs into the Feather River as a continuous flow for fish resources located in the low-flow channel between the Thermalito Diversion Dam and the Thermalito Afterbay outlet. The average annual generation in a median water year at the Thermalito Pumping-Generating Plant is 24,000 MWh. This plant does not have the capacity to pump flows upstream.

The Thermalito Power Canal is a 10,000-foot-long, 320-acre channel designed to convey generating flows from the Hyatt Pumping-Generating Plant to the Thermalito Pumping-Generating Plant, which operates in tandem with the Hyatt Pumping-Generating Plant.

<u>Thermalito Power Canal</u>

- Flows through the Thermalito Power Canal can be in either a downstream direction into Thermalito Forebay, or upstream to the Thermalito Diversion Dam, subject to Hyatt Pumping-Generating Plant generation or pumping operations, respectively.
- The water level in the Thermalito Power Canal is generally consistent with the elevations of the Thermalito Diversion Pool and Thermalito Forebay, with elevation varying up to about 4–6 feet as a result of head loss and depending on flow conditions.
- The Thermalito Power Canal is concrete lined for about 80 percent of its length, and unlined for about 20 percent at the transition to Thermalito Forebay.

Flows passing through the Thermalito Generating-Pumping Plant empty into the 4,300-acre Thermalito Afterbay, which is contained by a 42,000-foot-long earthfill dam.

The limited storage in Thermalito Forebay and Thermalito Afterbay is used to maximize the value of energy production and to maintain flows in the Feather River downstream of the Oroville Facilities. The pump-back operations are designed to use water discharged through the Hyatt Pumping-Generating Plant in excess of what is required for downstream flow requirements for pumping back into Thermalito Forebay and then into Lake Oroville. The water can be pumped back in off-peak energy hours and is then re-released for generation during peak hours when energy demand is higher. Hourly operations for power production are dictated primarily by the needs of the State power grid and the ancillary service requirements such as spinning reserve, the supplemental energy market, and voltage regulation. Because the power plants are operated to maximize weekday generation when energy demand is higher, there is usually higher storage in the afterbay by the end of the week. During the weekend, water from the afterbay continues to be released to the Feather River, generation at the Hyatt and Thermalito Pumping-Generating Plants is reduced, and pump-back into Lake Oroville may occur. By the end of the weekend, the elevation of Thermalito Afterbay is lowered to prepare for a similar operation the following week.

<u>Thermalito Forebay</u>

- Generally, there are no seasonal patterns to Thermalito Forebay storage or elevation, as the reservoir does not have sufficient capacity.

- The forebay varies in elevation from approximately 221 feet to 224.5 feet, a range of about 3.5 feet.
- Thermalito Forebay regulates discharge from the Hyatt Pumping-Generating Plant (or Hyatt's withdrawal during pumping mode), influencing the pool elevation for the Thermalito Power Canal and Thermalito Diversion Pool.

Thermalito Afterbay

- Generally, there are no seasonal patterns to Thermalito Afterbay storage or elevation, as the reservoir does not have sufficient capacity.
- Thermalito Afterbay helps provide water for agricultural uses.
- Thermalito Afterbay regulates the inflow from the Thermalito Pumping-Generating Plant (and withdrawal during its pump-back mode), as well as the releases through the Thermalito Afterbay outlet to the Feather River.

Decisions regarding the timing of power generation at the Oroville Facilities are made in accordance with SWP and CVP goals and responsibilities, the energy demands of the State power grid, the market value of energy and capacity, and ancillary services, through routine coordination with USBR, other SWP facilities, and real-time monitoring of water quality conditions in the Delta. The Oroville Facilities are limited in their ability to generate power by the need to first address water supply requirements for the FRSA and environmental programs in the Delta.

Power Generation and Exchange

Overall, the SWP uses more energy than it produces. To balance SWP energy loads with available resources, DWR relies upon a suite of options that include generation; day-ahead and hour-ahead markets, capacity and energy exchanges, and energy contracts (both short-term and long-term).

Load Management

The SWP controls the timing of its pumping load through an extensive computerized network. That control system allows DWR to minimize the cost of power it purchases by maximizing SWP pumping operations during off-peak periods when power costs are lower—usually at night—and to sell available excess power on the spot market during on-peak periods when power values are higher. By taking advantage of this flexibility in scheduling SWP pumping load and generation, DWR reduces the net cost for SWP water deliveries. The Oroville Facilities are integral to this operation.

Overall DWR is a net consumer of power because SWP generating plants (including the three Oroville Facilities plants) produce less power than is needed to meet annual SWP pumping (load) requirements. When generation from the Oroville Facilities (and other SWP power plants) exceeds SWP load requirements, DWR sells the surplus power through the ISO. This allows DWR to minimize overall project operating costs.

However, it should be recognized that DWR only has a power surplus on a limited basis and only during certain times of the day or seasons of the year, and so only a limited amount of annual benefit can be derived through participation in the ISO. Currently, DWR contracts with utilities and marketers for short-term purchase, sale, or exchange of power. In addition to selling firm power, DWR may sell power on a day-to-day or hour-to-hour basis according to the terms of its interchange agreements and of the Western System Power Pool agreement. These agreements provide the basis for making economy energy transactions, short-term capacity and energy sales or exchanges, unit commitments, and transmission service purchases.

3.3.2.5 Recreation and Other Environmental Commitments, Facilities, and Programs

Recreation Facilities

The majority of recreation facilities in the project area are within the Lake Oroville State Recreation Area (LOSRA), which has numerous facilities and sites that offer diverse recreational opportunities. LOSRA, managed by DPR, includes Lake Oroville and the surrounding lands and facilities within the project area, as well as the land and waters in and around the Thermalito Diversion Pool and Thermalito Forebay, downstream of Oroville Dam. Lake Oroville is one of the largest reservoirs in California, with more than 15,000 surface acres at full pool. The Thermalito Diversion Pool and Thermalito Forebay are stable, cool water reservoirs of 320 and 630 acres, respectively.

There are also recreational facilities and opportunities within the project area but outside LOSRA, specifically at Thermalito Afterbay, OWA, and at the Feather River Fish Hatchery. Each of these areas is managed by DFG. Thermalito Afterbay is a 4,300-acre, shallow reservoir that receives water released from Lake Oroville and passes through Thermalito Forebay and the Thermalito Pumping-Generating Plant. OWA and the Feather River Fish Hatchery and their operation are described below.

The most popular activities in the project area are swimming, motorboating, bank fishing, water-skiing, boat fishing, use of personal watercraft (PWC), tent camping, houseboating, bicycling, horseback riding, picnicking, recreational vehicle (RV) use, camping, and hiking (EDAW 2003). Nearly all of the major recreation areas, marinas, and campgrounds at the Oroville Facilities were developed after the dam was completed; most of these were operational by 1970-71. Temporary improvements were made to some facilities to accommodate low water levels in 1991. Additional recreational facilities and upgrades were ordered by FERC in 1994. These upgrades and new facilities diversified recreation opportunities and made existing facilities more attractive. The following recreational facilities are maintained and operated under the current FERC license:

- North Thermalito Forebay Boat Ramp (BR) and DUA;
- South Thermalito Forebay BR/DUA;

- Thermalito Afterbay boat ramps: Monument Hill, Wilbur Road, and Larkin Road;
- Monument Hill BR/DUA;
- OWA primitive camping and access;
- Lime Saddle Campground and DUA;
- Boat-in campsites: Craig Saddle Area, Goat Ranch Area, Bloomer Area, and Foreman Creek Area;
- Loafer Creek Campground/BR/DUA;
- Bidwell Canyon Campground/BR/DUA;
- Car-top boat ramps: Dark Canyon, Nelson Bar, Vinton Gulch, Stringtown, and Foreman Creek;
- Spillway BR/DUA;
- Enterprise BR/DUA;
- Diversion Pool DUA;
- Lake Oroville Visitors Center;
- Lake Oroville floating campsites and restrooms;
- Marinas at Lime Saddle and Bidwell Canyon; and
- Equestrian, bicycle, and hiking trails.

Boating

Several types of boating activities occur at LOSRA: houseboating; water-skiing; and use of PWC, small motorized fishing boats, large powerboats, and nonmotorized boats such as sailboats, windsurfers, canoes, and kayaks.

Two marinas are run by DPR concessionaires to support the needs of boaters, including boat rentals, fuel, pump-out of holding tanks, and basic supplies. The Bidwell Canyon area is the site of the primary marina and one of the larger boat ramps; camping facilities are close to the marina. A second concessionaire-run marina providing similar services is located at Lime Saddle, where there is also a major boat ramp. There are two additional major boat ramps at Lake Oroville—at the Spillway and Loafer Creek Recreation Areas—and one minor boat ramp, the Enterprise BR. Five car-top boat ramps are located around Lake Oroville: Vinton Gulch, Stringtown, Nelson Bar, Dark Canyon, and Foreman Creek. Several of the major boat ramps and car-top boat ramps provide boaters access to Lake Oroville at both high and low water levels.

Fishing

Fishing is a very popular activity at LOSRA. Lake Oroville's water is stratified, allowing for a "two-story" fishery that supports both coldwater and warmwater fish species. The coldwater fish use the deeper, cooler, well-oxygenated areas, whereas the warmwater fish use the warmer, shallower areas of the reservoir.

The warmwater fishery has spotted bass, largemouth bass, smallmouth bass, redeye bass, bluegill, green sunfish, black crappie, white crappie, channel catfish, and white catfish. Spotted bass are among the most commonly caught fish in Lake Oroville. The coldwater fish include rainbow, brook, and brown trout and Chinook and coho salmon. Both the brown trout and coho salmon are stocked and comprise the bulk of the cold water fishery.

Coldwater fish are caught primarily from boats and the shore of the reservoir, but are also caught in the rivers and creeks that are tributaries of Lake Oroville, as well as river sections below Oroville Dam. OWA provides access to the majority of the upper reaches of the mainstem Feather River (below the dam), the most popular area for steelhead and salmon fishing on the river. This area also has numerous ponds that hold many of the same warmwater species as in Lake Oroville. The Thermalito Afterbay outlet, located within OWA, is the most popular fishing spot in Butte County, hosting tens of thousands of anglers each year.

Camping

Camping is also a popular activity at LOSRA. There are facilities available for four types of campers: RV campers, car campers, boat-in campers, and floating campsite campers. Those with RVs have designated sites within several of the developed campsites and can camp in a self-contained manner (without hookups) at several of the boat ramps, such as the Spillway. Car camping is available at several of the developed sites throughout LOSRA, where many sites are located near trails (e.g., Loafer Creek) and day use areas such as beaches or picnic areas. The floating campsites may be reached only by boat and generally are located in the quieter arms of Lake Oroville. The boat-in campsites are used generally during high water because access from the water is easier at that time. These camps offer the most primitive camping experience available at LOSRA.

Other Activities

Nature study is an activity at LOSRA and OWA because of accessibility and the abundance of habitats. The diversity of avian species and habitat prompted the Audubon Society to name OWA a “significant bird area.” Hunting occurs in limited areas during the appropriate seasons, primarily in OWA. Use of firearms is not allowed within LOSRA. Species managed for hunting by DFG are deer, dove, quail, waterfowl, pheasant, and turkey. The Feather River Fish Hatchery offers visitor tours of the facility and allows visitors to view fish during spawning at the fish ladder through underwater viewing windows. A model airplane flying facility is located near Thermalito Afterbay. Two shooting ranges are available for use near the Oroville Facilities but outside of the FERC boundary. Other activities include trail use, day use/picnicking, and swimming.

Oroville Wildlife Area

As outlined in Section 3.3.1, OWA is an 11,000-acre area that is managed for wildlife habitat, recreational activities, and gravel mining. It includes Thermalito Afterbay and surrounding lands, and also a 5,000-acre wildlife area that encompasses a portion of the Feather River and the borrow area that supplied the clay and aggregate used for Oroville Dam construction. OWA straddles 12 miles of the Feather River, an area that includes willow and cottonwood–bordered ponds, islands, and channels.

As a result of interagency agreements negotiated between DWR and DFG, DFG manages the afterbay and other OWA locations. The first significant management agreement was executed in 1968, when DWR transferred to DFG "control and possession" of the borrow area and adjacent property along the Feather River. This agreement set forth DFG responsibility for establishing, operating, and maintaining a public fish and wildlife management area and providing for recreation on that property. In addition, DFG became responsible for all costs associated with operation and maintenance.

The second significant management agreement was negotiated between DWR and DFG in 1986. This agreement transferred an easement to DFG for management of the Thermalito Afterbay water surface and adjoining lands for use as a State Wildlife Area and associated recreation. DWR did not transfer possession of the property but established an easement to allow DFG access and management responsibilities. DFG became responsible for all costs associated with operation and maintenance of this property as part of the OWA, although some afterbay recreation facilities have subsequently been constructed and are maintained by DWR.

Operations and Maintenance of OWA

DFG maintains an operation and maintenance facility for OWA. These facilities include an administration building with several offices, a large barn that stores heavy machinery and equipment (e.g., tractors) along with a workshop, a hazardous materials storage building, and another large building with one side completely open for storing boats and other outdoor equipment. The hazardous materials storage facility contains oil and gas products along with herbicides for controlling weeds within OWA.

DFG is responsible for providing staff to manage and operate OWA[3] and sets guidelines for public use of this area. DFG allows public use 1 hour before sunrise to 1 hour after sunset; a designated area for overnight camping allows for a maximum stay of 14 nights in any calendar year. However, it is not always possible to enforce these hours or stay limits. DFG has periodically conducted controlled burning to reduce fuel loading in various locations, primarily around Thermalito Afterbay. In addition, DFG has

[3] This area retained full-time on-site staff members until March 1, 2004. Budget cuts have currently caused DFG to reassign some staff members to other Wildlife Areas.

constructed and maintained fuel breaks in several locations to reduce the potential for spread of wildfire.

Habitat Enhancement within OWA
DFG has conducted a regular habitat enhancement program. These activities have included the planting of upland nesting cover and foraging vegetation for waterfowl, along with thinning/removal of vegetation around the Thermalito Afterbay brood ponds and dredging ponds in the preserve. The thinning/removal activities are conducted to provide improved access for waterfowl. Approximately 200 acres of land are tilled and planted each year and remain as suitable nesting/foraging habitat for approximately 5 years before beginning to revert to the existing grasses. In addition, DFG thins and removes vegetation in and around ponds and rock piles to provide appropriate waterfowl habitat. Planting seed mixtures include triticale, mung beans, oats, fava beans, wheat, and safflower.

Wood Duck Volunteer Program
DFG maintains wildlife nest boxes each year with the help of public volunteers. Although these nest boxes are intended for wood ducks, many other types of wildlife also use them. The work associated with the nest box program includes cleaning as well as replacing those that are in disrepair.

Mosquito Abatement

DFG does not directly conduct mosquito abatement programs within OWA. However, the annual operating budget includes up to $40,000 (including up to $20,000 that is contributed by DWR) per year that is paid to the Butte County (County) and City of Oroville (City) mosquito abatement programs. This program consists of spraying pesticides in amounts and locations determined appropriate by abatement program staff.

Feather River Fish Hatchery

The Feather River Fish Hatchery was constructed by DWR in 1967 to compensate for habitat lost to spawning salmon as a result of the construction of Oroville Dam. The hatchery artificially spawns thousands of returning salmon and steelhead each year.

DFG operates the hatchery under contract to DWR, and DWR pays all hatchery-associated expenses, except for some costs as part of the enhancement of the Thermalito facilities. Operational activities at the hatchery are monitored and modified through the FERC process.

Hatchery Operation and Maintenance
The Fish Barrier Dam diverts fish into a ladder leading to the hatchery. All fish are stopped at the barrier dam. When the gates are open, upstream migrating fish can move into the 0.5-mile-long ladder leading to the hatchery. As fish reach the end of the ladder, they swim into the gathering tank and a mechanical sweep moves the fish into the spawning building. Salmon and steelhead that are not ready to be artificially

spawned are moved to one of four circular holding tanks. The main hatchery building houses the spawning operation and incubators.

Spring-Run Chinook Salmon. Spring-run Chinook, with run designation based on the time adults enter fresh water, hold over in the Feather River during the summer. The fish ladder gates are opened on or about September 1 to allow the adult spring run to enter the hatchery. The early entries are ready for spawning in October. Fish entering the hatchery after September 15 are considered fall-run.

Traditionally, hatchery staff members collected sufficient males and females to provide the egg take and smolt production goals, taking into account the estimated losses through the rearing process. The goal is to have sufficient fish on hand to meet planting goals in the following spring with no surplus to handle. All salmon adults entering the hatchery are retained for egg taking or fertilization. The entire process of egg/milt collection, fertilization, incubation, rearing, and holding of fry, fingerlings, and yearlings was conducted within the facilities. However, because of continuing disease problems, this program was stopped and the expanded hatchery area was shut down temporarily. The current inland reservoir program consists of obtaining coho salmon eggs from a salmon farming operation in the Pacific Northwest and rearing the eggs at the Thermalito Afterbay facility. After maturing to the appropriate weight in the raceways, fish are planted in Lake Oroville.

Beginning in April, spring-run production fish are transported to a release site at the eastern end of San Pablo Bay. By this time, the young salmon have undergone a physiological transformation to enable them to enter salt water and are called smolts.

Fall-Run Chinook. The same general operations guidelines apply to fall-run Chinook; that is, taking spawners throughout the run, using more than one male to fertilize each female's eggs, and matching egg take to production goals. The major difference is that eggs from fall-run Chinook are allocated each year to enhancement production at the Thermalito and Mokelumne production facilities.

Enhancement fall-run Chinook produced at the Thermalito facility are trucked to San Pablo Bay with the salmon produced at the Feather River Fish Hatchery. Fish produced at the Mokelumne River facility are trucked separately to the same location.

Steelhead Rainbow Trout. Unlike Pacific coast salmon, not all adult steelhead die after spawning; therefore, adult steelhead spawned at the hatchery are released alive. The fish ladder gate is open continuously through the fall and winter, as long as fish with viable eggs ascend the hatchery ladder. Hatchery steelhead are reared to the yearling stage and released in the Feather River. All steelhead production fish are marked with an adipose fin clip and a small, magnetic coded wire tag inserted in the head. The external fin clip allows anglers to determine quickly whether the fish is of hatchery origin (and can be kept), and the coded wire tags allow biologists to determine whether it originated at the Feather River Fish Hatchery.

Experimental Hatchery Releases

Approximately 15 to 20 percent of the Feather River fall and spring-run Chinook salmon production is marked and released for experimental purposes. Marking consists of clipping the adipose fins and inserting a specially coded magnetic tag in the head. Specific examples of the purposes of these releases are to:

- Evaluate the hatchery contribution to ocean and inland harvest, straying to other streams, and return to the Feather River;
- Evaluate the effects of stocking different sizes and numbers of Chinook salmon on the Lake Oroville fish community and angler harvest;
- Evaluate factors influencing survival of Chinook salmon through the Delta; and
- Evaluate different strategies for release of production fish in the Feather River, the Delta, and San Pablo Bay.

Fish Barrier Dam Operations

Flow over the dam maintains fish habitat in the bypassed reach of the Feather River between the Feather River Fish Hatchery and the Thermalito Afterbay outlet.

Instream Flows for Fish Resources in the Feather River

Flows for fisheries protection are managed to meet criteria set forth by DFG, USFWS, NOAA Fisheries, and FERC. Under the terms of a 1983 agreement between DWR and DFG, a minimum instream flow of 600 cfs is stipulated for the low-flow channel between Thermalito Diversion Dam and the Thermalito Afterbay outlet. This flow may be provided from the diversion dam outlet, the diversion dam powerhouse, or the Feather River Fish Hatchery pipeline.

Additionally, a 1984 FERC order states that upon completion of construction of the Thermalito Diversion Dam Power Plant, DWR shall operate the Oroville Facilities in such a manner as to maintain a minimum flow of 600 cfs within the Feather River downstream of Thermalito Diversion Dam. Downstream of the Thermalito Afterbay outlet, the license requires a minimum release so that flows in the Feather River are 1,000 cfs from April through September, and 1,700 cfs from October through March when the April–July unimpaired runoff in the Feather River is greater than 55 percent of normal. When the April–July unimpaired runoff is less than 55 percent of normal, the license requires minimum flows of 1,000 cfs from March to September and 1,200 cfs from October to February. This requirement is to protect any spawning that could occur in overbank areas during the higher flow rate by maintaining flow levels high enough to keep the overbank areas submerged. In practice, flows are maintained below 2,500 cfs from October 15 to November 30 to prevent spawning in the overbank areas.

In 2002, NOAA Fisheries issued a BO on the interim operations of the CVP and the SWP on the listed Threatened Central Valley spring-run Chinook salmon and Central Valley steelhead. The BO established ramping rates to minimize fluctuating flows on various life stages of Chinook salmon and steelhead. Table 3.3-5 outlines the minimum instream flow requirements.

Table 3.3-5. Combined minimum instream flow requirements in the Feather River below Thermalito Afterbay outlet.

Projected Lake Oroville Elevation (Current Water Year), and Water Conditions for April–July of Preceding Water Year	Period	Minimum Flows
Projected Lake Oroville Elevation: Greater than 733 feet *Water Conditions:* ≥ 55 percent of normal [1]	October–February	1,700 cfs
	March	1,700 cfs
	April–September	1,000 cfs
Projected Lake Oroville Elevation: Greater than 733 feet *Water Conditions are* < 55 percent of normal [1]	October–February	1,200 cfs
	March	1,000 cfs
	April–September	1,000 cfs
Projected Lake Oroville Elevation: Less than 733 feet [2]	October–February	900 cfs < Q < 1,200 cfs
	March	750 cfs < Q < 1,000 cfs
	April–September	750 cfs < Q < 1,000 cfs

1. "Normal" is the mean April–July unimpaired runoff of the Feather River near Oroville of 1,942,000 af (1911–1960).

2. In accordance with the FERC Order Amending License dated September 18, 1984, Article 53 was amended to provide a third tier of minimum flow requirements defined as follows: If the April 1 runoff forecast in a given water year indicates that, under normal operation of Project 2100, the reservoir level will be drawn to elevation 733 feet (approximately 1.5 maf), releases for fish life in the above schedule may suffer monthly deficiencies in the same proportion as the respective monthly deficiencies imposed on deliveries of water for agricultural use from the project. However, in no case shall the fish water releases in the above schedule be reduced by more than 25 percent.

Source: DWR and DFG 1983.

<u>Thermalito Afterbay outlet Operations</u>

The Thermalito Afterbay outlet is operated to meet minimum instream flow requirements as well as to meet demands for SWP delivery and Delta environmental protection. Minimum flow requirements representing the combined discharge from the Thermalito Afterbay outlet with flow released into the low-flow channel below the Thermalito Diversion Pool are as follows:

- Flow releases through the Thermalito Afterbay outlet do not normally vary on an hourly or even daily basis, but instead are scheduled on a weekly basis.
- In practice during October 15–November 30, flows are maintained below 2,500 cfs to prevent spawning in overbank areas of the Feather River downstream of the confluence with the Thermalito Afterbay outlet.

- If the hourly flow exceeds 2,500 cfs during this period, unless the high flow resulted from flood management releases or mechanical problems, then the flow less 500 cfs must be maintained until the following March.

Temperature Requirements

The agreement with DFG also contains a narrative objective for water temperature below the Thermalito Afterbay outlet and a numerical objective for water temperature provided to the Feather River Fish Hatchery. Below the Thermalito Afterbay outlet, temperatures must be suitable for fall-run Chinook salmon during fall months after September 15. From May through August, temperatures must be suitable for shad, striped bass, and other warmwater fish.

NOAA Fisheries has also established a criterion for steelhead trout and spring-run Chinook salmon. The NOAA Fisheries BO issued in 2002 on the effects of the CVP and SWP on Central Valley spring-run Chinook and steelhead requires DWR, as a reasonable and prudent measure, to control water temperature at 65°F or less on a daily average at Feather River Mile 61.6 (Robinson Riffle in the low-flow channel) from June 1 through September 30. The requirement is not intended to preclude pump-back operations at the Oroville Facilities needed to assist the State of California with supplying energy during periods when the California ISO anticipates a Stage 2 or higher alert.

Under the agreement with DFG, the water supply for the Feather River Fish Hatchery must adhere to specific water temperature objectives for time periods throughout the year, with a deviation of +/- 4°F allowed for the period of April 1–November 30. Water temperature objectives are met through use of a shutter-controlled intake gate system that selects water for release from various depths in Lake Oroville. The hatchery objectives are 52°F for September, 51°F for October and November, 55°F for December–March, 51°F for April–May 15, 55°F for the last half of May, 56°F for June 1–15, 60°F for June 16–August 15, and 58°F for August 16–31. Table 3.3-6 lists the fish hatchery water temperature objectives.

The hatchery and river water temperature objectives sometimes conflict with temperatures desired by agricultural diverters who claim a need for warmer water during spring and summer for rice germination and growth (i.e., 65°F from approximately April through mid-May and 59°F during the remainder of the growing season). To the extent practical, DWR uses its operational flexibility to accommodate the temperature goals of the agricultural diverters.

Table 3.3-6. Fish hatchery water temperature objectives.

Period	Temperature (+/- 4°F)
April 1–May 15	51°
May 16–May 31	55°
June 1–June 15	56°
June 16–August 15	60°
August 16–August 31	58°
September 1–September 30	52°
October 1–November 30	51°
December 1–March 31	55°

Source: DWR and DFG 1983.

Hyatt Pumping-Generating Plant Operations—Temperature Control

- The water temperature of releases from Lake Oroville can be regulated to meet water temperature objectives downstream as a result of the multilevel intake structures.
- Two multilevel intake structures serve the six Hyatt units, each consisting of sloping structures with 13 control shutters and ranging in elevation from about 650 feet to 900 feet.
- The intake structures in Lake Oroville serve as diffusers of water pumped back from the Thermalito Diversion Pool.

Thermalito Diversion Pool—Temperature Control

- The Thermalito Diversion Pool serves as the primary location for monitoring the mixing of warmer and cooler temperature waters to meet the downstream temperature requirements at the Feather River Fish Hatchery and Robinson Riffle.
- During generating and pump-back operations, warmer water can be introduced into the pool when water is pumped back through the Thermalito Pumping-Generating Plant, while cooler water can be introduced when generating through the Hyatt Pumping-Generating Plant.
- The need to meet temperature requirements can sometimes dictate the timing of pumping and generation operations at the Oroville Facilities.

Thermalito Afterbay Outlet—Temperature Control

- The 1983 agreement between DWR and DFG specifies a narrative water temperature objective for fall-run salmon (after September 15) and from May through August for warmwater fish, including shad and striped bass.
- DWR must maintain daily average water temperatures at < 65°F in the Feather River upstream of the confluence with the Thermalito Afterbay outlet at Mile 61.6 (Robinson Riffle in the low-flow channel) from June 1 through September 30.
- Maintenance of water temperature at this site governs temperatures downstream to some extent.

Fisheries Enhancement Program

Measures pertaining to fisheries primarily address concerns regarding fish habitat improvement, minimum flows, and facility operations that conserve and develop fish resources. Measures pertaining to the DWR Fish Habitat Improvement Plan require planting of trees and vegetation to improve fish habitat. Other measures address discharge of harmful substances and maintenance of minimum flows.

Fire Protection and Fuels Management

The primary fire management programs in and immediately surrounding the Oroville facilities are managed by the USFS, California Department of Forestry and Fire Protection (CDF), and DPR. The BLM, DFG, the County, and the City also have lands within the vicinity and fire management or suppression policies. These policies are discussed in Chapter 9.0, Consistency with Comprehensive Plans.

Objectives of the State Water Project

The Oroville Facilities are operated to provide downstream water supply for municipal, industrial, and irrigation purposes to meet the requirements of the SWC. Releases are made from the Oroville Facilities first to satisfy the contractual water supply commitments to the FRSA, and then to provide flows for SWP obligations to support the 1995 WQCP before being exported from the Delta to meet the requirements of the SWC. The SWP is operated in coordination with the federal CVP to balance water supply and environmental programs, especially in the Delta. Discharges from Lake Oroville supplement the inflow to the Delta from other sources, including a number of State and federal reservoirs, which allows for exports to the SWP and the CVP.

The SWP and CVP are operated under the terms of a Coordinated Operation Agreement (COA) dated November 24, 1986, between DWR and USBR. This agreement superseded a previous coordination agreement from 1960 and various annual operating agreements. The COA describes the means and methods whereby the SWP and CVP will share responsibilities and facilities to meet annual water supply targets, which include 2,674 taf for the SWP, 3,762 taf for the CVP, and 4,986 taf as joint responsibility for water supply in the Delta and for outflow to San Francisco Bay.

Operation of the Oroville Facilities is directly affected by terms of the agreement for the sharing of responsibility for meeting Sacramento River in-basin water use, including water to meet standards for water quality in the Delta, because the Oroville Facilities are the largest source of SWP water storage available to meet those requirements in the Sacramento River basin.

The SWP's Delta export water supply obligations are met with whatever water is available after environmental requirements in the Delta are met. Each year, the supply of water to meet Delta requirements and water supply deliveries is determined by the hydrological inputs to the entire SWP and CVP systems, the balancing of responsibilities between the SWP and the CVP, and the year-to-year variations in the environmental requirements of the 1995 WQCP. The distribution of water releases from the Oroville Facilities for multiple downstream uses is illustrated in Table 3.3-2, using DWR records from 2001 and 2002.

3.4 OVERVIEW OF AFFECTED ENVIRONMENT

3.4.1 Introduction

Sections 3.4.2 through 3.4.21 of this document provide an overview of the current conditions (e.g., existing facilities and resources, usage, and visitation) in the Oroville Facilities project area. Each section covers a separate resource area or topic, as follows:

- Section 3.4.2: Water Use and Hydrology
- Section 3.4.3: Flood Management
- Section 3.4.4: Power Generation and Capacity
- Section 3.4.5: Aesthetic Resources
- Section 3.4.6: Agricultural Resources
- Section 3.4.7: Air Quality
- Section 3.4.8: Aquatic Biological Resources
- Section 3.4.9: Botanical Resources
- Section 3.4.10: Cultural Resources
- Section 3.4.11: Geology and Geomorphology
- Section 3.4.12: Land Use, Management, and Planning
- Section 3.4.13: Noise
- Section 3.4.14: Paleontological Resources

- Section 3.4.15: Public Services
- Section 3.4.16: Public Health and Safety
- Section 3.4.17: Recreation
- Section 3.4.18: Socioeconomics
- Section 3.4.19: Transportation and Traffic
- Section 3.4.20: Water Quality
- Section 3.4.21: Wildlife Resources

The types and causes of potential impacts of the primary alternatives on these resource areas, and the methods of analysis to be used for the January 2005 PDEA, are described by resource area in Sections 4.2 through 4.23 in Chapter 4.

3.4.2 Water Use and Hydrology

While the Oroville Facilities provide power, recreation, and environmental benefits, their primary purposes are to provide flood control and water to downstream water users. The Oroville Facilities are operated to provide water to two major users, the FRSA and the SWC. Water to serve the FRSA is primarily diverted from Thermalito Afterbay, while water is released down the Feather River and rediverted at downstream locations to meet SWC requests.

The Oroville Facilities alter the streamflow in the Feather River by regulation at Lake Oroville and diversion for water supply and hydropower. Streamflow alterations vary with the availability of water, which can be described by considering different hydrologic water year types. Water year types are determined according to the Sacramento Valley water year type definitions including Critical, Dry, Below Normal, Above Normal, and Wet.

CALSIM II modeling is being used to simulate operations of the SWP, including the Oroville Facilities, under different types of conditions. These conditions include existing conditions used to define the affected environment (the related model scenario is sometimes referred to on this project as the “existing conditions benchmark study”). These modeling results are being used to define not only existing hydrology conditions but also projected hydrology conditions under each of the primary action alternatives. Additional modeling with HYDROPS is being used to evaluate more detailed local operations and related hydrology conditions. (These models and some of the other analytical tools being used on this project are described in Appendix D, Modeling Tools; additional information regarding the water use and hydrology modeling approach is found in Section 4.2.) Output from these models also is being used to describe water use (or modeled DWR water deliveries) associated with existing conditions (under 2001 level of development) for the January 2005 PDEA. The subsections below summarize initial results of the water use and hydrology modeling under existing conditions, including general streamflow and reservoir level information.

3.4.2.1 Water Use

Annual water deliveries to meet FRSA demands and SWC requests under modeled existing conditions are provided in Table 3.4.2-1 below and illustrated in Figure 3.4.2-1. These water deliveries are simulated deliveries using CALSIM II and will be used as the baseline for the water use–related impact assessments being conducted for each of the primary alternatives to be defined and assessed for the January 2005 PDEA. Additional information regarding the CALSIM II model is found in Appendix D, Modeling Tools. Appendix D describes the modeling assumptions used in the CALSIM II existing conditions model runs.

Water diversions to meet FRSA demands occur primarily during the irrigation season, April–October. Under existing conditions, the average annual diversion of water to meet FRSA demands is about 995,000 acre-feet per year (afy). The minimum and maximum annual diversions over the modeling period of record are 613,000 afy and 1,057,000 afy, respectively.

Water is required in all months of the year to meet SWC requests, with the highest requests typically in June through August and the lowest in January. Water available for delivery varies depending on hydrologic conditions and operating requirements (also referred to as commitments; see Section 3.3). Under existing conditions, the average annual delivery to meet SWC demands south of the Delta is about 3,058,000 afy. The maximum and minimum annual deliveries over the modeling period of record are 3,914,000 afy and 761,000 afy, respectively.

Table 3.4.2-1. Modeled water supply deliveries under existing conditions (annual average deliveries by water year type, 2001 level of development).

Annual Feather River Service Area Delivery (taf)						
	Wet	**Above Normal**	**Below Normal**	**Dry**	**Critical**	**All Water Year Types—Annual Average**
Mean	1,027	1,034	1,031	1,026	820	995
Max	1,051	1,057	1,054	1,048	1,048	1,057
Min	951	1,007	906	988	613	613
Annual SWP South-of-Delta Delivery (taf)						
	Wet	**Above Normal**	**Below Normal**	**Dry**	**Critical**	**All Water Year Types—Annual Average**
Mean	3,545	3,467	3,506	2,802	1,682	3,058
Max	3,905.2	3,913.9	3,880.0	3,721.9	3,528.8	3,914
Min	3,186.4	2,601.1	2,982.3	1,408.2	761.2	761

Note: taf = thousand acre-feet.
Sources: DWR 2004, CALSIM II 2001 Existing Conditions Benchmark Modeling Results

3.4.2.2 Hydrology

Surface Water Hydrology

Historical hydrology data for the Feather River basin are contained in Appendix C. That appendix also provides detailed charts that illustrate the range of historical river flow releases, power plant discharges, reservoir storage volumes, and pool elevations for all of the major features of the Oroville Facilities. Following is a brief summary of key operating parameters.

Lake Oroville is generally operated to store water during the winter (when most of the watershed's rainfall occurs) and spring snowmelt periods and make releases in the summer-to-fall period. During above-normal or wet years, the reservoir typically fills to capacity, or near capacity, in May or June. In drier years, the reservoir reaches its maximum elevation as early as March, and does not fill to capacity, thus reducing DWR's ability to deliver water to south-of-Delta water users (as shown by the reduced south-of-Delta deliveries in critical and dry water years in Table 3.4.2-1). The reservoir typically reaches its minimum in the September–January time period. Typical end-of-month surface elevations at Lake Oroville under existing conditions are shown in Figure 3.4.2-1.

Water released from Lake Oroville is diverted around the Feather River low-flow channel for power production. During most water years, mean monthly flows in the low-flow channel are about 600 cfs, the existing minimum flow requirement. In some above-normal and wet years, releases from storage can be larger than the capacity of the power generation facilities, requiring additional water to be released down the low-flow channel. This is especially true during times of reservoir spill or in anticipation of spill conditions. Typical mean monthly flows in the low-flow channel under existing conditions are illustrated in Figure 3.4.2-1.

Water passing through the Thermalito Pumping-Generating Plant flows through the Tail Channel and into Thermalito Afterbay, where it is stored and re-regulated. From Thermalito Afterbay, water can be used in a variety of ways, including pump-back into Lake Oroville, release to meet FRSA demands, or release to the Feather River to meet downstream requirements. Thermalito Afterbay operation varies significantly on a weekly basis and from month to month. When pump-back operations are in effect, the elevation of Thermalito Afterbay is typically at its highest for the week on Friday and at its lowest on Sunday. Although the modeling work is not yet completed for Thermalito Afterbay, Figure 3.4.2-1 illustrates the surface elevation fluctuation for a typical week of operations under various scenarios. These scenarios include peaking and pump-back operation, peaking only, and neither peaking nor pump-back. Further data on afterbay levels will be available once the modeling work is completed. (Historical operation data are provided in Appendix C.) Water is released from Thermalito Afterbay to the Feather River, where it joins with the flow in the low-flow channel and is used to meet downstream SWC demands.

The flow in the Feather River below Thermalito Afterbay varies with the downstream water releases for the SWP deliveries, water availability, and the many commitments DWR has related to releases for downstream water quality control, flood management releases, and other purposes. In above-normal or wet years, the maximum flow in the Feather River typically occurs during February or March because of high reservoir inflows that necessitate relatively large releases for flood control purposes. In drier years, the maximum flow typically occurs in July or August, when releases from storage are required to meet downstream water demands by the SWC. Typical mean monthly flows in the Feather River below Thermalito Afterbay under existing conditions are illustrated in Figure 3.4.2-1.

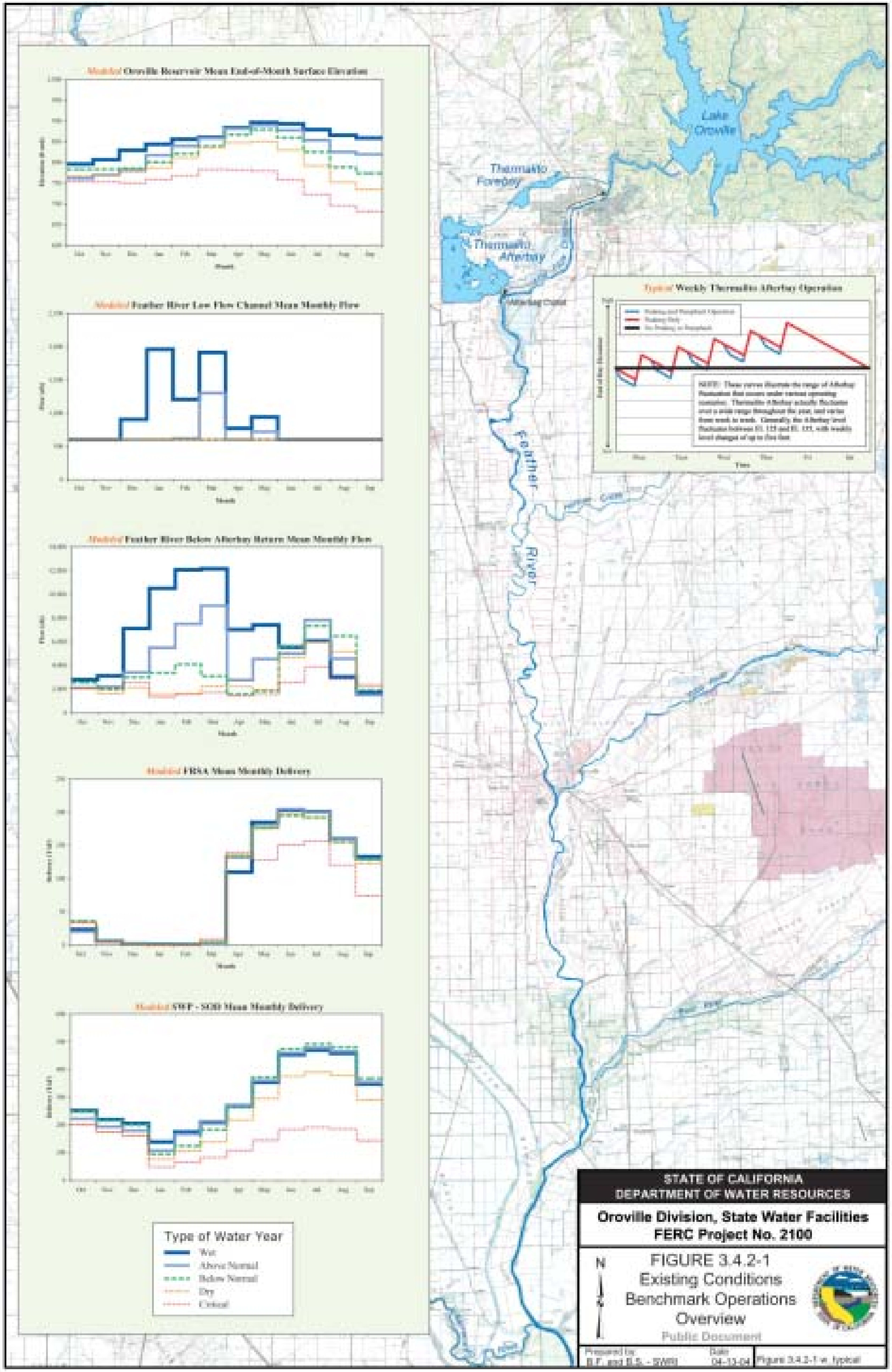
Groundwater Hydrology

Oroville Dam and Lake Oroville are underlain by relatively impermeable igneous and metamorphic bedrock that largely eliminates interaction between groundwater and Lake Oroville. However, Thermalito Forebay and Thermalito Afterbay are located on more permeable volcaniclastic and consolidated alluvial sediments where reservoir water and local groundwater do interact. The afterbay was constructed on an older, dissected upland, consisting of coarse gravels cemented in a sandy clay matrix. The upland area is adjacent to the edge of the groundwater basin to the west where younger alluvial materials overlap the older sediments. The younger sediments consist of alluvial fan, stream, and basin deposits. Existing lithology data from well driller reports indicate that there are at least two aquifers in the area, a confined zone and an unconfined zone, and there may be localized areas of semiconfined zones. Aquifer zones are not uniform in thickness, nor is there much uniformity in the depth that different aquifer materials are encountered in area wells.

Groundwater flows in a south-southwest direction in the vicinity of Thermalito Forebay and Thermalito Afterbay. Localized seepage occurs from these reservoirs and pumps have been installed to return the water to the reservoirs. Water levels in the Feather River below the Oroville Facilities have a potential effect on local groundwater; however, this effect has not yet been defined. Study Plan W-5, Project Effects on Groundwater, is under way with specific goals to evaluate surface water and groundwater interaction. Once the study is complete, this relationship will be better understood and results will be presented in the January 2005 PDEA document.

3.4.3 Flood Management

The Oroville Facilities are an integral component of the flood control system for the areas along the Feather and Sacramento Rivers downstream of Oroville Dam. They have had a major positive effect by reducing both the magnitude and the frequency of flooding for Oroville, Marysville, Yuba City, and many smaller communities. Records indicate that immense floods occurred in the latter half of the 19th century and into the early 20th century. The effects of these floods on affected communities were devastating.



Modeled Oroville Reservoir Mean End-of-Month Surface Elevation
Modeled Feather River Low Flow Channel Mean Monthly Flow
Modeled Feather River Below Afterbay Return Mean Monthly Flow
Modeled FRSA Mean Monthly Delivery
Modeled SWP - SOD Mean Monthly Delivery
Type of Water Year
Wet
Above Normal
Below Normal
Dry
Critical
Lake Oroville
Thermalito Forebay
Thermalito Afterbay
Afterbay Outlet
Feather River
Typical Weekly Thermalito Afterbay Operation
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
FIGURE 3.4.2-1
Existing Conditions
Benchmark Operations
Overview
Public Document
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The Oroville Facilities also provide protection to about 283,000 acres of highly developed agricultural lands and to important highway and railroad routes. The total value of structures and contents in the areas along the Feather River protected by Oroville Dam is nearly $3 billion (USACE 1999).

During the flood season, from October through March, the Oroville Facilities are operated under flood control rules specified by USACE. These rules require operation of the Oroville Facilities to help manage flood flows in the Feather and Sacramento Rivers. The goal of operations for flood control is to prevent flows in the Feather River at Oroville from exceeding 150,000 cfs while at the same time meeting flow restrictions at other locations farther down the Feather River. Oroville Dam and Lake Oroville are to be operated in conformance with the flood control regulations prescribed by the Secretary of the Army pursuant to federal law (58 Stat. 890; 33 USC 709). Under those regulations, 750 taf or more of storage space is to be maintained in Lake Oroville during the winter months to capture significant inflows from runoff and snowmelt.

The operation of Oroville Facilities for flood management is described in more detail in Section 3.3. The flood reservation boundaries established by the USACE flood operation rules are illustrated in Figure 3.3-3, and Table 3.3-4 presents significant spills of record.

3.4.4 Power Generation and Capacity

The energy market in California recently went through a period of instability as a result of restructuring and power supply shortages. This resulted in volatility in the California energy market, causing power prices to temporarily rise to levels well above normal. What this power industry restructuring and recent volatility means for the future energy market in California is hard to predict. However, it is safe to say that electricity demand, though erratic in recent years, is expected to continue to grow.

Oroville Facilities are an important energy resource for the State. The continued operation of the three Oroville Facilities power plants provides 762 MW of licensed capacity and roughly 2,500,000 MWh of energy annually. This project meets a wide range of capacity, energy and ancillary services needs. Project generation over the past 20 years has ranged from a low of 1,200,000 MWh (1991) to a high of 4,000,000 MWh (1982). This power capacity is vital to the State, in that it provides a large portion of the electricity needed each year to pump water throughout the SWP service area. The Oroville Facilities power plants operate in conjunction with, and are integral to the hourly operation of, other SWP power plants and the USBR’s CVP. Their primary operating function is to provide electricity to power pumps that move water within the SWP service area. Overall, the SWP uses more energy than its eight power plants produce. Generation from the Oroville Facilities to help meet these pumping needs generally occurs only as water is released from Lake Oroville to meet water supply and flood management objectives. Any decrease in energy production at the Oroville Facilities must be offset by increased purchases of energy from more costly sources, or construction of new generating facilities. In calendar year 2000, the SWP required 9,190,000 MWh of generation to meet pumping requirements and station service usage of its 25 pumping and generating plants. In 2000, the Oroville Facilities produced roughly 2,760,000 MWh of that total, which amounts to about one-third of the system's total requirements.

The Oroville Facilities decrease reliance on power generation by nonrenewable fossil fuels, which contributes to the production of oxides of nitrogen (NO_x) and oxides of sulfur (SO_x), which in turn contributes to air pollution. To balance SWP loads with available resources, DWR relies on a suite of options that includes purchases from the ISO's day-ahead and hour-ahead power markets, capacity exchange; and energy contracts (both short- and long-term). Two such contracts with Southern California Edison Company (SCE) allow DWR to exchange on-peak capacity and energy for off-peak energy that is used to power SWP pumping operations. Specifically, under the terms of the 1979 Power Contract and the 1981 Capacity Exchange Agreement, DWR provides SCE with up to 350 MW of capacity and approximately 40 percent of the energy from the Oroville Facilities. In return, DWR receives off-peak energy from SCE equal to the amount of energy provided to SCE from the Oroville Facilities, plus an additional amount of energy as payment for the capacity. The amount of additional energy is determined annually based on the Capacity-Energy Exchange Formula defined in the 1979 Power Contract. These agreements are scheduled to terminate in December 2004.

3.4.5 Aesthetic Resources

Lake Oroville, Oroville Dam, and the Thermalito Diversion Pool lie within the Sierra Nevada foothill landscape region, which is a transition zone between the Sacramento Valley floor and the steeply sloped, higher elevation lands of the Sierra Nevada. The foothills are characterized by moderately to steeply sloped ridges and deep, steep-sided canyons, and the vegetative cover is a mosaic of chaparral and forests of gray pine and blue oak. There is relatively little development in this area.

The Thermalito Forebay and Thermalito Afterbay facilities, the OWA, and the low-flow channel are located in the flat Sacramento Valley landscape region. The visual character of these areas is defined by a mix of agriculture and low-density urbanization. The agricultural areas include lands used for irrigated row crops and orchards, and irrigated and non-irrigated grazing. Many areas along the low-flow channel are lined by riparian forests of tall trees and thick shrubs. Parts of the low-flow channel and the Feather River Fish Hatchery are located near the City of Oroville in an area that has a low-density urban character.

Project facilities and operations are an important element of the affected aesthetic/visual environment. Some of the major project facilities that are prominent in the Oroville area include the following:

- *Lake Oroville*—A major aesthetic/visual feature visible from recreation areas around the reservoir, and from the Kelly Ridge residential area, other scattered residences, and several transportation routes.
- *Oroville Dam*—An earthfill structure approximately 1.3 mile long and 770 feet high; a massive visual element and regional landmark in the aesthetic/visual environment of the Oroville area.
- *Transmission Lines from the Hyatt Pumping-Generating Plant*—Two lines of double-circuit towers carrying three 230-kilovolt (kV) circuits that extend approximately 9 miles from the Hyatt Pumping-Generating Plant switchyard to the Table Mountain Substation; very visible in a relatively limited area.
- *Thermalito Diversion Pool*—A long (approximately 4.5 miles), narrow pool that has a riverine appearance; little fluctuation is seen from relatively few areas.
- *Thermalito Diversion Dam and Thermalito Diversion Dam Power Plant*—A 1,300-foot-long, 143-foot-high dam; visible in a very limited area, primarily from looking downstream from the Thermalito Diversion Pool and looking upstream from the portion of the low-flow channel near the Feather River Fish Hatchery and the Feather River Nature Center.
- *Thermalito Power Canal*—A 10,000-foot-long straight concrete lined canal; the canal and an adjacent chain link fence are visible to the public primarily from three overpasses that cross over them.
- *Thermalito Forebay*—An hourglass-shaped, 630-acre reservoir that is most visible from two recreation areas and several transportation routes.
- *Thermalito Forebay Dam*—A 3-mile-long, 91-foot-high dam visible throughout South Thermalito Forebay and from Grand Avenue.
- *Thermalito Pumping-Generating Plant*—A rectangular building that houses 145 MW of generating capacity, including 1 generating unit and 3 pump-generating units.
- *Thermalito Afterbay Dam*—An “L”-shaped, 8-mile-long earthfill dam that is no more than 39 feet in height; the dam has a very strong visual presence along the west and southern side of Thermalito Afterbay. SR 99 parallels the western levee for approximately 4 miles, and SR 162 crosses the afterbay.
- *Thermalito Afterbay*—A 4,300-acre (6.7-square-mile) reservoir visible from many locations in the project area.
- *Feather River Fish Hatchery*—A facility that includes a 0.5-mile-long fish ladder, offices, underwater fish viewing area, restrooms, two lighted parking areas, a spawning-hatchery building, rearing channels, and other facilities.

- *Fish Barrier Dam and Fish Barrier Pool*—A 91-foot-high, 600-foot-long concrete dam with extensive spillway and a linear fish barrier pool approximately 50 acres in size.
- *Debris Piles and Dumping Sites*—A number of sites that have been used for project storage and waste storage and nonproject waste storage and are unsightly.

Project operations (primarily the seasonal lowering and raising of Lake Oroville) influence the aesthetic/visual environment. When Lake Oroville is at relatively lower elevations, the shoreline and debris on the shoreline are exposed and contrast with the surrounding aesthetic/visual environment. Project operations at the Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay result in minor reservoir fluctuations.

3.4.6 Agricultural Resources

The State of California is the number one agricultural producer and exporter in the United States, earning $27.6 billion in agricultural markets in 2001. Land use surrounding the Oroville Facilities includes urban and built-up land, grazing land, and irrigated and nonirrigated crops. Crop types downstream of Thermalito Afterbay along the Feather River include field crops, pastureland, grain and hay, fruit, and nuts. Agricultural land adjacent to Thermalito Afterbay is cultivated to produce fruit and nut crops and rice.

The Oroville Facilities are located in Butte County, where the most valuable crop is rice. Butte County ranks third in the State for rice production, preceded only by Colusa County and Glenn County (CDFA Website). The county's milled rice, planted on 98,000 acres, generated 18 percent ($112.3 million) of California's gross value of agricultural production of rice in 2000 (CASS Website).

During the May–August irrigation season, monthly irrigation diversions of up to 150,000 af are currently made from the Thermalito Complex. (Moving from upstream to downstream, the complex includes Thermalito Diversion Dam, Thermalito Diversion Dam Power Plant, Thermalito Forebay, Thermalito Pumping-Generating Plant, and Thermalito Afterbay.) Annual diversions total slightly less than 1 maf, leaving about 3 maf for flow in the Feather River downstream of the Oroville Facilities (DWR 2001).

Water diversions from the Thermalito Complex are made to the Biggs–West Gridley Water District, Richvale Irrigation District, Western Canal Water District, and Butte Water District. The Biggs–West Gridley Water District diverts water from three diversion points—the Belding Lateral diversion point, the Dietzler Lateral diversion point, and the Lateral #8 diversion point. The Richvale Irrigation District diverts water from the Richvale Canal and from the Richvale Biggs Extension at Minderman. Water diversions made by the Butte Water District are calculated by elimination, whereby diverted water not accounted for by the other districts is charged to the Butte Water District.

In May 1969, DWR entered into agreements with several water districts to provide them with water based upon prior rights (DWR 1969). The agreement among the Richvale Irrigation District, Biggs–West Gridley Water District, Butte Water District, Sutter Extension Water District (i.e., the Joint Water District), and DWR includes terms describing the amounts of water that the State is required to make available to the districts. According to some growers, rice production requires warmer water during the spring and summer for germination and growth (i.e., 65°F from approximately April through mid-May, and 59°F during the remainder of the growing season [pers. comm., Robbins 2000 as cited in DWR 2001]).

3.4.7 Air Quality

Air quality in the project area is regulated by several agencies: the U.S. Environmental Protection Agency (USEPA), California Air Resources Board (ARB), and the Butte County Air Quality Management District (BCAQMD). USEPA has established national ambient air quality standards (NAAQS), and ARB has established California ambient air quality standards (CAAQS) for the protection of human health and welfare; these standards were used to develop the standards of significance described in Section 4.7.

The BCAQMD is the agency primarily responsible for ensuring that NAAQS and CAAQS are not exceeded in Butte County. In an attempt to maintain air quality, the BCAQMD, in coordination with the other air districts in the Northern Sacramento Valley Air Basin (NSVAB), completed the 2000 Air Quality Attainment Plan (AQAP). The 2000 AQAP addresses the progress made in implementing the 1997 AQAP and proposed modifications to the strategies necessary to attain the State ozone standard.

The primary pollutants of regional concern within the NSVAB are ozone precursors (i.e., reactive organic gases [ROG] and NO_x) and airborne particulates. Over the last 5 years, ozone emissions in the NSVAB, including Butte County, have been trending downward. The decreases in ozone precursors have resulted largely from increased motor vehicle controls and reductions in evaporative emissions. On August 25, 1999, Butte County experienced peak smoke impacts from local wildfires, and ozone levels at the local monitoring station reached 0.135 part per million (ppm), well above the federal standard of 0.12 ppm. Before this exceptional event, Butte County exceeded the federal 1-hour standard only once in the past 20 years (BCAQMD Website).

In contrast to ozone, emissions of particulate matter less than 10 microns in diameter (PM_{10}) have increased in the NSVAB. This increase resulted from growth in emissions from areawide sources, primarily fugitive dust sources. Emissions of directly emitted PM_{10} from mobile and stationary sources have remained relatively steady. The federal 24-hour PM_{10} standard has not been exceeded in Butte County (BCAQMD Website).

Butte County is currently designated as a nonattainment area with respect to the State 1-hour ozone and PM_{10} ambient air quality standards. The county recently attained the federal 1-hour ozone standard. As a result, Butte County is currently designated "transitional nonattainment" for the federal 1-hour ozone standard. Attainment status designations for the recently adopted federal 8-hour ozone and $PM_{2.5}$ standards have not yet been assigned (BCAQMD Website).

3.4.8 Aquatic Biological Resources

Operation of the Oroville Facilities influences environmental conditions within the lower Feather River, as well as within Lake Oroville and its upstream tributaries, the Thermalito Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the Feather River Fish Hatchery, the Fish Barrier Pool, and the OWA ponds. Approximately 47 fish species occur in streams and reservoirs influenced by the Oroville Facilities.

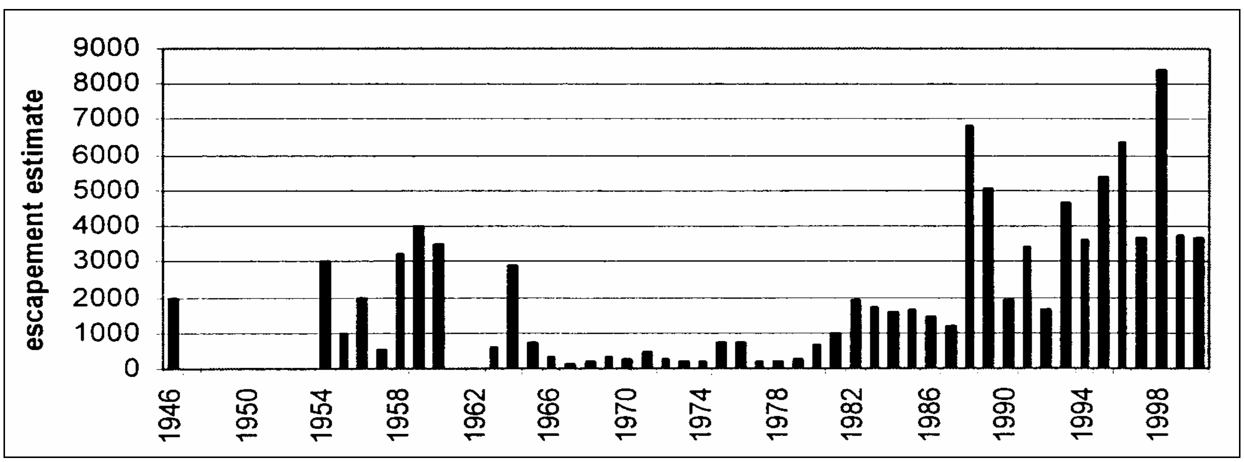
The environmental effects of hydroelectric projects on aquatic resources can be separated into two categories: (1) those effects associated with reservoirs, and (2) those effects associated with streams or rivers. The timing, magnitude, frequency, and duration of water level fluctuations are the most important factors affecting aquatic resources within reservoirs. Water level changes, in turn, influence the physical environment of the reservoir, including water quality and the availability of habitat. The quality of the physical environment influences the dynamics of all biological resources in the reservoir. As with reservoir water level fluctuations, the timing, magnitude, frequency, and duration of releases from reservoirs to streams affect the aquatic resources of the streams by influencing physical habitat and water quality. The analysis of aquatic biological resources focuses on evaluating how reservoir fluctuations affect the volume of coldwater habitat in Oroville Facilities reservoirs, and for those reservoirs supporting warmwater sport fish, how fluctuations influence reproduction and the viability of self-sustaining fish populations. The analysis also focuses on evaluating how reservoir releases affect the physical habitat of aquatic resources and the quality of the water to which those resources are exposed in the lower Feather River.

Potentially affected species of primary concern include:

- State and/or federally listed species within the project study area (spring-run Chinook salmon and Central Valley steelhead);
- Species that are recreationally or commercially important (fall-run Chinook salmon, Central Valley steelhead/trout, American shad, coho salmon, striped bass, and four species of black bass);
- Candidate species for listing under the California Endangered Species Act (CESA) or Federal Endangered Species Act (FESA) (fall-run Chinook salmon and green sturgeon); and

- State species of special concern (fall-run Chinook salmon, Sacramento splittail, green sturgeon, river lamprey, and hardhead).

Of particular interest and importance is the distribution of Chinook salmon and steelhead spawning and rearing habitat affected by the Oroville Facilities and their operation. Before the construction of the major dams in the Central Valley, an estimated 6,000 miles of spawning and rearing habitat was accessible to Chinook salmon and steelhead. Currently, an estimated 95 percent of this habitat is blocked by dams or other obstructions (USFWS in CPUC 2000). DWR constructed the Feather River Fish Hatchery in 1967 to compensate for salmonid spawning habitat lost with construction of Oroville Dam. The facility accommodates an average of 8,000 adult fish per year. The hatchery can accommodate 15,000–20,000 adult fish annually. Each year, approximately 9,000–18,000 salmon and 2,000 steelhead are artificially spawned. Historically, the Feather River spring-run Chinook salmon population was similar in magnitude to the size of the present hatchery run (Figure 3.4.8-1). Spring-run Chinook salmon ascended the very highest streams and headwaters of the Feather River watershed before the construction of hydropower dams and diversions (DFG 1998 in DWR and USBR 2001). Before Oroville Dam (1946–1963), available population estimates ranged from 500 to 4,000 fish and averaged 2,200 per year (DFG 1998 in DWR and USBR 2001). However, Feather River spring-run Chinook salmon had probably been significantly affected by hydropower facilities in the upper watershed well before completion of Oroville Dam. For instance, DFG (1998 in DWR and USBR 2001) found substantial overlap in the spawning distributions of fall-run and spring-run Chinook salmon upstream of the Oroville Dam site.



Sources: DWR and USBR 2001.

Figure 3.4.8-1. Estimated adult spring-run Chinook salmon population abundance in the Feather River, California.

As in several of the other spring-run streams, returns of spring-run Chinook salmon to the Feather River Fish Hatchery suggest that the population has been increasing slightly in the recent past (DWR and USBR 2001). This population trend could be caused by a large number of potentially contributing factors, some occurring within the project area and others unrelated to project operations (e.g., ocean cycle survival, decadal cycles), as will be assessed further in the cumulative effects analysis included in the January 2005 PDEA.

The aquatic resources within the Oroville Facilities study area are managed by a variety of entities and agencies—private (e.g., conservation organizations), local (e.g., county fish and game commissions), State (e.g., DFG), and federal (e.g., NOAA Fisheries). For example, minimum flows in the lower Feather River were established by a 1983 agreement between DWR and DFG for preservation of salmon spawning and rearing habitat. In addition, in 2002, NOAA Fisheries issued a BO on the interim operations of the CVP and SWP on federally listed threatened Central Valley spring-run Chinook salmon and Central Valley steelhead (NOAA Fisheries 2002). This BO established quantitative water temperature criteria for the lower Feather River to protect over-summering steelhead (those that remain through the summer) from thermal stress and warmwater predator species. The NOAA Fisheries BO also established ramping rates to minimize adverse effects of flow fluctuations associated with upstream reservoir operations on incubating eggs, fry, and juvenile spring-run Chinook salmon and steelhead.

3.4.9 Botanical Resources

The Oroville Facilities are located within the foothill physiographic zones of California's Sierra Nevada mountains. This includes the eastern edge of the Sacramento Valley and the lower foothills of the Sierra Nevada mountain range. Broad vegetation patterns correspond with elevational changes from the valley floor to the upper elevations of the mountain ranges. Oroville's botanical resources include vegetation communities, special-status plant species, and noxious or invasive weeds.

3.4.9.1 Vegetation Communities

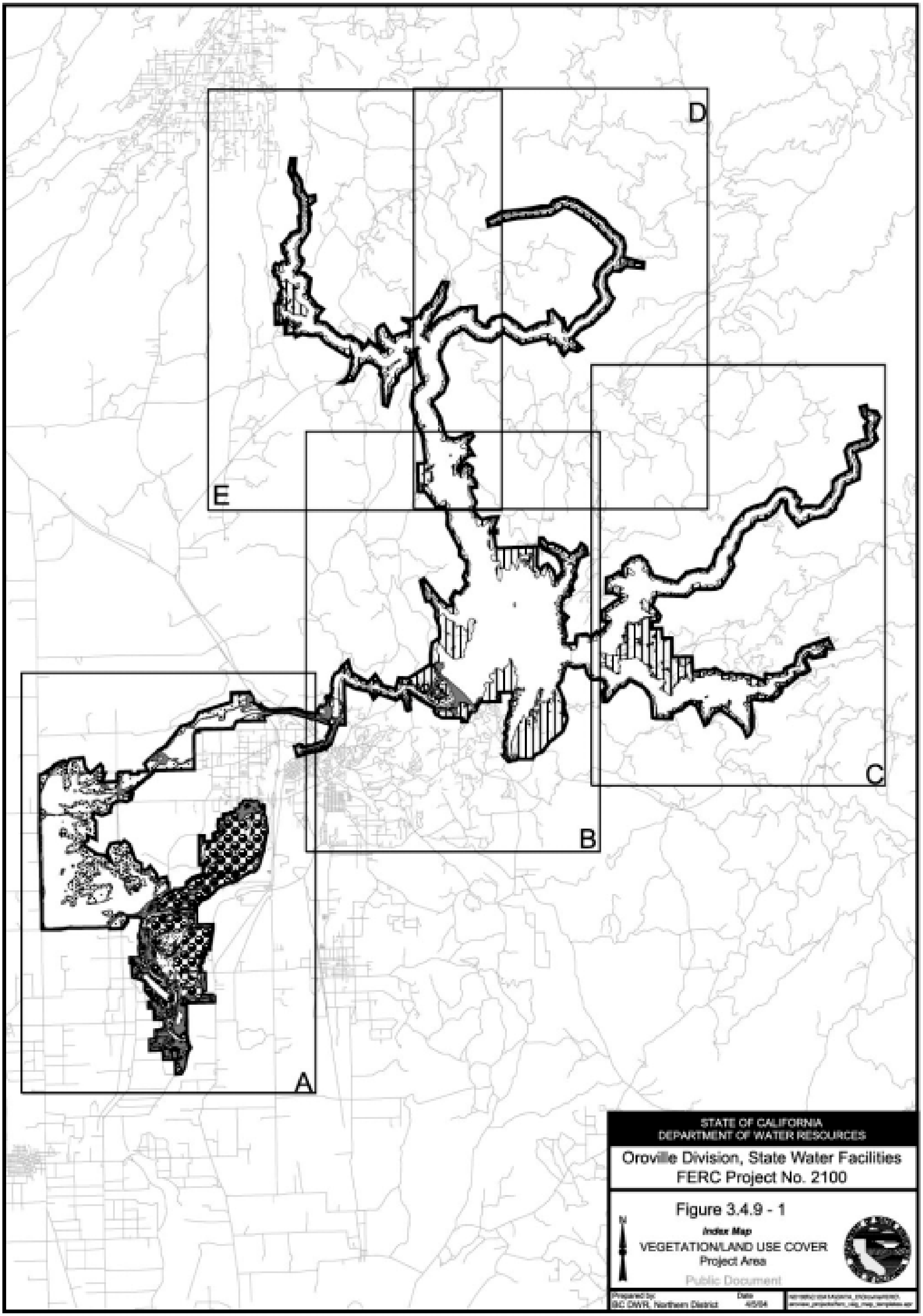
General vegetation/land use types and acreages occurring within the FERC boundary, plus a 1-mile area beyond the FERC boundary, are listed in Table 3.4.9-1 and Figures 3.4.9-1 through 3.4.9-6 and are based on aerial photography (DWR 2003a). More than 31,000 acres of vegetation in the Feather River floodplain outside the FERC boundary have also been identified and mapped, half of which consist of agricultural types.

Nearly half (20,000 acres) of the 41,000 acres within the FERC boundary are surface waters. The remainder consists of native vegetation and developed and disturbed areas. Large tracts of native vegetation surround Lake Oroville, Thermalito Forebay, Thermalito Afterbay, and the Feather River. Lands surrounding Lake Oroville consist mostly of foothill woodlands, forests, and chaparral communities. California annual grassland and riparian/wetlands are the dominant vegetation types below Oroville Dam and the Thermalito Diversion Pool. Vernal pool and swale complexes are a common part of the valley grassland habitats in this area. These pools are of the Northern Hardpan type and occur in complexes in areas of hummocky ground on terrace-alluvial derived Redding soils (DFG 1998).

Table 3.4.9-1. Plant communities.

General Community Types	Number of Associations* per Community Type*	Inside FERC Boundary		One mile outside FERC Boundary	
		Acreage	%	Acreage	%
Aquatic/Submerged	5	443	1.1	33	<0.1
Disturbed/Other/Agriculture	15	2,454	6.0	21,396	21.2
Open Water	5	19,796	48.0	767	0.8
Riparian Forest/Woodland	12	3,252	7.9	1,043	1.0
Riparian Shrub/Scrub	8	201	0.5	286	0.3
Upland Forest/Woodland	22	11,102	27.0	62,145	61.8
Upland Shrub/Herbaceous	7	2,982	7.3	14,506	14.4
Wetland	7	912	2.2	347	0.3
Unknown		--		13	<0.1
Total acres		41,142		100,536	

** Associations based on Holland (1986) and Sawyer and Keeler-Wolf (1995)*
Source: DWR 2003a



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C
B
A
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.9 - 1
Index Map
VEGETATION/LAND USE COVER
Project Area
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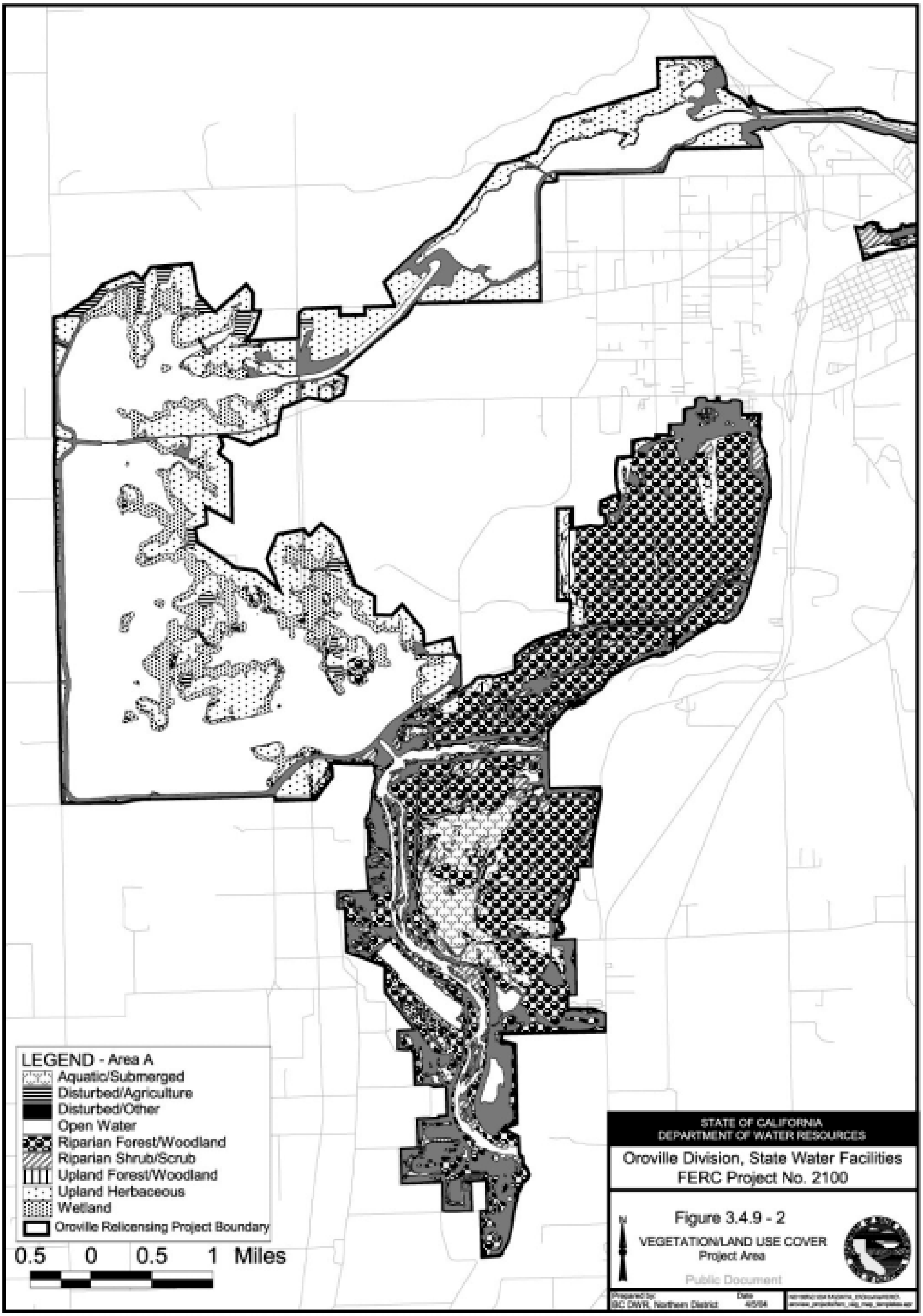
LEGEND - Area A
Aquatic/Submerged
Disturbed/Agriculture
Disturbed/Other
Open Water
Riparian Forest/Woodland
Riparian Shrub/Scrub
Upland Forest/Woodland
Upland Herbaceous
Wetland
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.9 - 2
VEGETATION/LAND USE COVER
Project Area
Public Document
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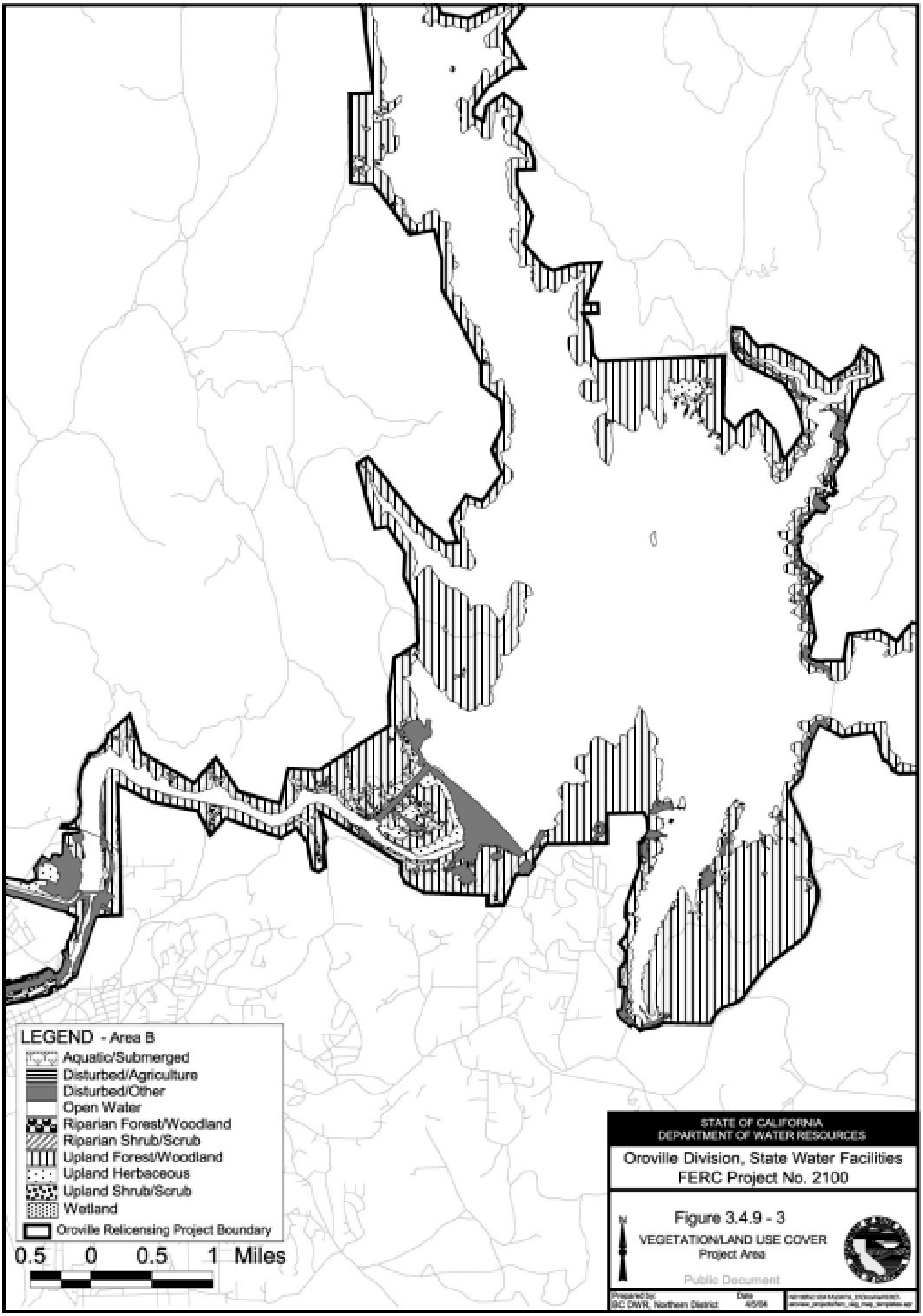
LEGEND - Area B
Aquatic/Submerged
Disturbed/Agriculture
Disturbed/Other
Open Water
Riparian Forest/Woodland
Riparian Shrub/Scrub
Upland Forest/Woodland
Upland Herbaceous
Upland Shrub/Scrub
Wetland
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.9 - 3
VEGETATION/LAND USE COVER
Project Area
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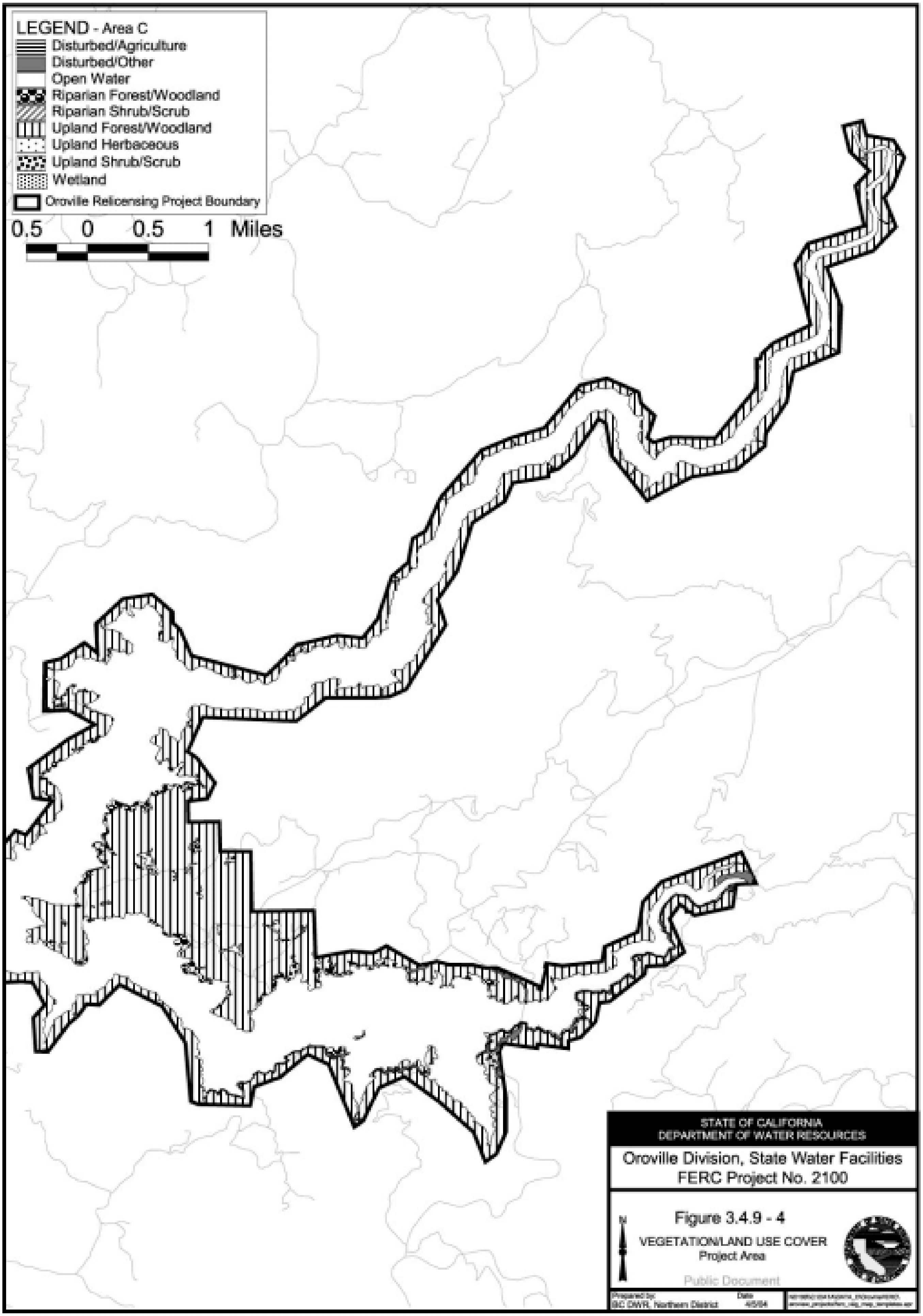

LEGEND - Area C
Disturbed/Agriculture
Disturbed/Other
Open Water
Riparian Forest/Woodland
Riparian Shrub/Scrub
Upland Forest/Woodland
Upland Herbaceous
Upland Shrub/Scrub
Wetland
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.9 - 4
VEGETATION/LAND USE COVER
Project Area
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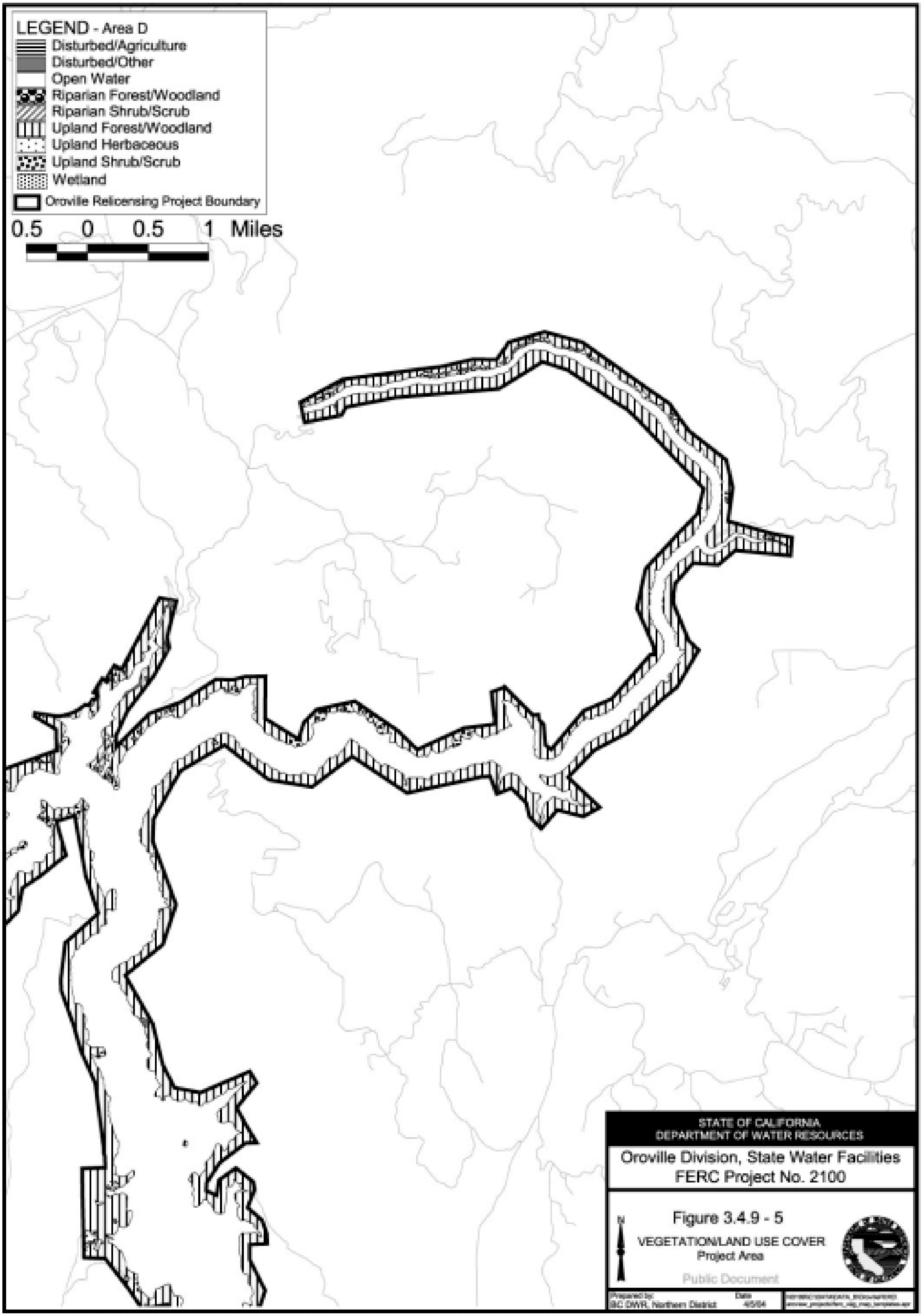
Date
4/5/04


LEGEND - Area D
Disturbed/Agriculture
Disturbed/Other
Open Water
Riparian Forest/Woodland
Riparian Shrub/Scrub
Upland Forest/Woodland
Upland Herbaceous
Upland Shrub/Scrub
Wetland
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.9 - 5
VEGETATION/LAND USE COVER
Project Area
Public Document
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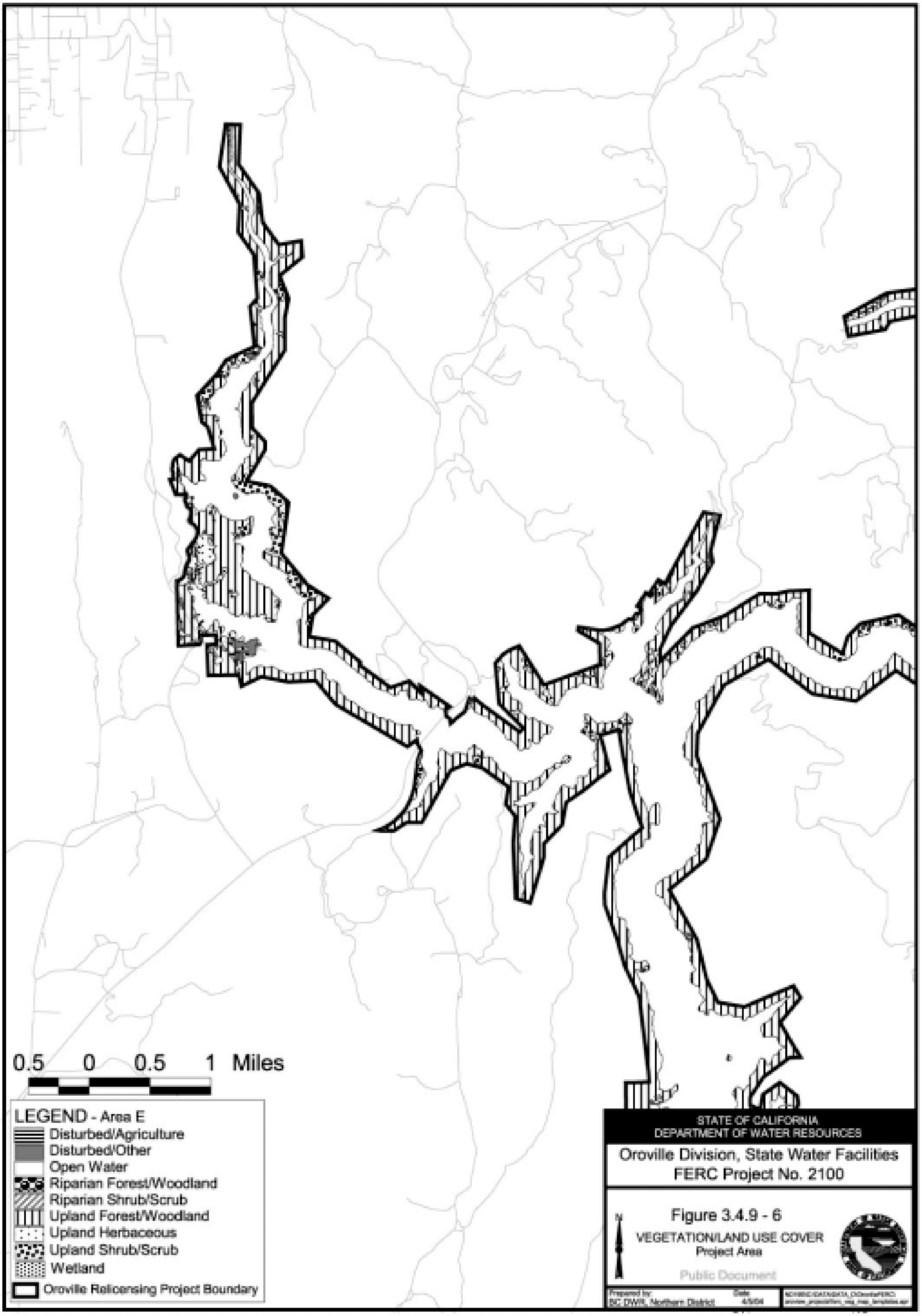

0.5 0 0.5 1 Miles
LEGEND - Area E
Disturbed/Agriculture
Disturbed/Other
Open Water
Riparian Forest/Woodland
Riparian Shrub/Scrub
Upland Forest/Woodland
Upland Herbaceous
Upland Shrub/Scrub
Wetland
Oroville Relicensing Project Boundary
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
N
Figure 3.4.9 - 6
VEGETATION/LAND USE COVER
Project Area
Public Document

3.4.9.2 Special-Status Plant Species

Special-status plants include those that are federally or State listed (listed) as Threatened, Endangered, or Rare; federal species of concern; those that are listed by the USFS or BLM as sensitive or special-interest species; and taxa on California Native Plant Society (CNPS) lists that have a ranking of 3 or less. Prior to relicensing studies, 7 listed species, 44 vascular, and 12 nonvascular special-status species (5 mosses and 7 lichens) were identified as potentially occurring in the project area (DWR 2002b). Relicensing studies indicate that potentially suitable habitat exists within the project area for 7 of the listed vascular species, 43 of the special-status species, and 3 of the nonvascular species (2 mosses and 1 lichen) (DWR 2004) (Table 3.4.9-2). No habitat for the federally and State listed Hartweg's golden sunburst (*Pseudobahia bahiifolia*) was located along the Feather River downstream of the project area.

Table 3.4.9-2. Special-status plant species with potential to occur within the project area.

Scientific Name **Common Name**	**Status USFWS[1]/ State[2]/ CNPS[3]/ Plumas NF[4]**	**Habitat (elevation)**	**Found in Project Area**
Federally or State Listed			
Chamaesyce hooveri Hoover's spurge	FT/--/1B/--	Vernal pools (25–250 meters [m])	
Limnanthes floccosa ssp. *californica* Butte County meadow foam	FE/SE/1B/--	Valley and foothill grassland (mesic), vernal pools (50–90 m)	
Orcuttia pilosa Hairy Orcutt grass	FE/SE/1B/--	Vernal pools (55–200 m)	
Orcuttia tenuis Slender Orcutt grass	FT/SE/1B/--	Vernal pools (35–1,760 m)	
Pseudobahia bahiifolia Hartweg's golden sunburst	FE/SE/1B/--	Cismontane woodland, valley and foothill grassland/clay (15–150 m)	
Senecio layneae Layne's ragwort	FT/SR/1B/ FT	Chaparral, cismontane woodland/ serpentinite or gabbroic (200–1,000 m)	
Tuctoria greenei Greene's tuctoria	FE/SR/1B/--	Vernal pools (30–1,070 m)	
Species of Concern—CNPS Lists 1, 2, & 3; USFS Sensitive or Special Interest; Federal Species of Concern			
Agrostis hendersonii Henderson's bent grass	SC/--/3/--	Valley and foothill grassland (mesic), vernal pools (70–305 m)	
Allium jepsonii Jepson's onion	SC/--/1B/--	Cismontane woodland, lower montane conifer forest/serpentinite or volcanic (300–1,160 m)	

Table 3.4.9-2. Special-status plant species with potential to occur within the project area.

Scientific Name **Common Name**	**Status USFWS[1]/ State[2]/ CNPS[3]/ Plumas NF[4]**	**Habitat (elevation)**	**Found in Project Area**
Allium sanbornii var. sanbornii Sanborn's onion	--/--/4/SI-1	Chaparral, cismontane woodland, lower montane conifer forest/usually serpentinite, gravelly (260–1,410 m)	
Arenaria "grandiflora" Large-flowered sandwort	--/--/4/SI-1	Granite sand on road banks and openings in woods (500–1,000 m)	
Balsamorhiza macrolepis var. *macrolepis* Big-scale balsamroot	--/--/1B/SI-1	Chaparral, cismontane woodland, valley and foothill grassland/sometimes serpentinite (90–1,400 m)	
Bulbostylis capillaris Thread-leaved beakseed	--/--/4/SI-2	Lower/upper montane conifer forest, meadows and seeps (395–2,075 m)	
Calycadenia oppositifolia Butte County calycadenia	--/--/1B/S	Chaparral, cismontane woodland, lower montane conifer forest, meadows and seeps, valley and foothill grassland/ volcanic or serpentinite (215–945 m)	Yes
Calystegia atriplicifolia ssp. *buttensis* Butte County morning glory	SC/--/1B/--S	Lower montane conifer forest (600–1,200 m)	
Cardamine pachystigma var. *dissectifolia* Dissected-leaved toothwort	--/--/3/SI-1	Chaparral, lower montane conifer forest/usually serpentinite, rocky (255–2,100 m)	Yes
Carex vulpinoidea Fox sedge	--/--/2/--	Marshes and swamps (freshwater), riparian woodland (30–1,200 m)	Yes
Castilleja rubicundula ssp. *rubicundula* Pink creamsacs	--/--/1B/--	Chaparral (openings), cismontane woodland, meadows and seeps, valley and foothill grassland/serpentinite (20–900 m)	
Clarkia biloba ssp. *brandegeae* Brandegee's clarkia	--/--/1B/S	Chaparral, cismontane woodland/often roadcuts (295–885 m)	Yes
Clarkia gracilis ssp. *albicaulis* White-stemmed clarkia	--/--/1B/S	Chaparral, cismontane woodland/ sometimes serpentinite (245–1,085 m)	Yes
Clarkia mildrediae ssp. lutescens Golden-anthered clarkia	--/--/4/SI-1	Cismontane woodland, lower montane conifer forest (openings)/often roadcuts (275–1,750 m)	
Clarkia mildrediae ssp. *mildrediae* Mildred's clarkia	--/--/1B/SI-1	Cismontane woodland, lower montane conifer forest/sandy, usually granitic (245–1,710 m)	
Clarkia mosquinii Mosquin's clarkia	SC[5]/--/1B/S	Cismontane woodland, lower montane conifer forest/rocky, roadsides (185–1,170 m)	Yes

Table 3.4.9-2. Special-status plant species with potential to occur within the project area.

Scientific Name **Common Name**	**Status USFWS[1]/ State[2]/ CNPS[3]/ Plumas NF[4]**	**Habitat (elevation)**	**Found in Project Area**
Cypripedium fasciculatum Clustered lady's slipper	SC/--/4/S	Lower montane conifer forest, north coast conifer forest/usually serpentinite seeps and streambeds (100–2,435 m)	
Downingia pusilla Dwarf downingia	--/--/2/--	Valley and foothill grassland (mesic), vernal pools (1–445 m)	
Eleocharis quadrangulata Four-angled spikerush	--/--/2/--	Marshes and swamps (freshwater) (30–500 m)	Yes
Erigeron petrophilus var. sierrensis Northern Sierra daisy	--/--/4/SI-2	Cismontane woodland, lower/upper montane conifer forest/sometimes serpentinite (300–1,980 m)	
Fritillaria eastwoodiae Butte County Fritillary	SC/--/3/S	Chaparral, cismontane woodland, lower montane conifer forest (openings)/ sometimes serpentinite (50–1,500 m)	Yes
Fritillaria pluriflora Adobe-lily	SC/--/1B/--	Chaparral, cismontane woodland, valley and foothill grassland/often adobe (60–705 m)	
Hibiscus lasiocarpus Rose-mallow	--/--/2/--	Marshes and swamps (freshwater) (0–120 m)	
Juncus leiospermus var. *ahartii* Ahart's dwarf rush	SC/--/1B/--	Valley and foothill grasslands (mesic) (30–100 m)	
Juncus leiospermus var. *leiospermus* Red Bluff dwarf rush	--/--/1B/--	Chaparral, cismontane woodland, meadows and seeps, valley and foothill grassland, vernal pools/vernally mesic (35–1,020 m)	
Lewisia cantelovii Cantelow's lewisia	--/--/1B/S	Broadleaved upland forest, chaparral, cismontane woodland, lower montane conifer forest/mesic, granitic, serpentinite seeps (385–1,370 m)	
Lilium humboldtii ssp. humboldtii Humboldt lily	--/--/4/SI-1	Chaparral, lower conifer forest/ openings (30–1,800 m)	Yes
Lupinus dalesiae Quincy lupine	--/--/1B/S	Chaparral, cismontane woodland, lower/upper montane conifer forest, openings, often in disturbed areas (855–2,500 m)	
Mimulus glaucescens Shield-bracted monkeyflower	--/--/4/SI-1	Chaparral, cismontane woodland, lower montane conifer forest, valley and foothill grassland/serpentinite seeps (60–1,240m)	Yes

Table 3.4.9-2. Special-status plant species with potential to occur within the project area.

Scientific Name **Common Name**	**Status USFWS[1]/ State[2]/ CNPS[3]/ Plumas NF[4]**	**Habitat (elevation)**	**Found in Project Area**
Monardella douglasii ssp. *venosa* Veiny monardella	SC/--/1B/--	Cismontane woodland, valley and foothill grassland (heavy clay) (60–410 m)	
Myosurus minimus ssp. *apus* Little mousetail	SC/--/3/--	Valley and foothill woodland, vernal pools (alkaline) (20–640 m)	
Paronychia ahartii Ahart's paronychia	SC/--/1B/--	Cismontane woodland, valley and foothill grassland, vernal pools (30–510 m)	Yes
Penstemon personatus Closed-throated beardtongue	SC/--/1B/S	Chaparral, lower/upper montane conifer forest, metavolcanic (1,065–2,120 m)	
Perideridia bacigalupii Bacigalupi's yampah	--/--/4/SI-1	Chaparral, lower montane conifer forest/serpentinite (450–1,000 m)	
Rhynchospora californica California beaked-rush	SC/--/1B/--	Bogs and fens, lower montane conifer forest, meadows and seeps, marshes and swamps (freshwater) (45–1,010 m)	
Rhynchospora capitellata Brownish beaked-rush	--/--/2/SI-1	Lower/upper montane conifer forest, meadows and seeps, marshes and swamps, mesic (455–2,000 m)	
Sagittaria sanfordii Sanford's arrowhead	SC/--/1B/--	Marshes and swamps (assorted shallow freshwater) (0–610 m)	Yes
Sedum albomarginatum Feather River stonecrop	--/--/1B/S	Chaparral, lower montane conifer forest/serpentinite (260–1,785 m)	
Senecio eurycephalus var. *lewisrosei* Cut-leaved ragwort	--/--/1B/S	Chaparral, cismontane woodland, lower montane conifer forest/serpentinite (550–1,470 m)	Yes
Sidalcea robusta Butte County checkerbloom	SC/--/1B/--	Chaparral, cismontane woodland (90–1,600 m)	
Silene occidentalis ssp. *longistipitata* Long-stiped catchfly	SC/--/1B/SI-1	Chaparral, lower/upper montane conifer forest (1,000–2,000 m)	
Trifolium jokerstii Butte County golden clover	--/--/1B/SI-1	Valley and foothill grassland (mesic), vernal pools (50–385 m)	
Wolffia brasiliensis Columbian watermeal	--/--/2/--	Marshes and swamps (assorted shallow freshwater) (30–100 m)	
Bryophytes			
Bruchia bolanderi Bolander's bruchia moss	--/--/2/S	Lower/upper montane conifer forest, meadows and seeps, damp soil (600–1,700 m)	

Table 3.4.9-2. Special-status plant species with potential to occur within the project area.

Scientific Name **Common Name**	**Status USFWS[1]/ State[2]/ CNPS[3]/ Plumas NF[4]**	**Habitat (elevation)**	**Found in Project Area**
Mielichhoferia elongata Elongate copper moss	--/--/2/SI-1	Cismontane woodland (metamorphic rock, usually vernally mesic) (500–1,300 m)	
Lichens			
Hydrothyria venosa Waterfan	--/--/--/S	Attached to rocks in cool mountain brooks and streams; submerged	

NOTES:
[1] *USFWS: FE - federal endangered, FT - federal threatened, SC - federal species of concern (not a formal listing).*
[2] *DFG: SE - State endangered, SR - State rare.*
[3] *CNPS: List 1B - plants rare, threatened, or endangered in California and elsewhere; List 2 - plants rare, threatened, or endangered in California but more common elsewhere; List 3 - plants about which more information is needed; List 4 - plants of limited distribution.*
[4] *Plumas National Forest (Plumas NF): S - Sensitive; SI-1 - Special Interest category 1 (Survey and recommend conservation measures); SI-2 - Special Interest category 2 (Report occurrences and recommend conservation measures).*
[5] *USFWS recognizes two subspecies of* Clarkia mosquinii, *ssp.* mosquinii *and ssp.* xerophila, *both as SC.*
Source: DWR 2004.

No federally listed or State-listed species were found within the project area. Approximately 49 acres of vernal pool and vernal swale habitat exists for Butte County meadowfoam (*Limnanthes floccosa* ssp. *californica*), Hoover's spurge (*Chamaesyce hooveri*), Hairy Orcutt grass (*Oructtia pilosa*), slender Orcutt grass (*Orcuttia tenuis*), and Greene's tuctoria (*Tuctoria greenei*). Approximately 172 acres of serpentine-derived soils and 64 acres of gabbro-derived soils exist within the project area for Layne's ragwort (*Senecio layneae*). Thirteen special-status plant species were identified within the project area during relicensing studies. Five of these were found within the OWA and the Thermalito Complex. Two species of concern, four-angled spikerush (*Eleocharis quadrangulata*) and Sanford's sagitarria (*Sagitarria sanfordii*), were found around the margins of Thermalito Afterbay. Four-angled spikerush was also found bordering Thermalito Forebay, small ponds in OWA, and One-Mile Pond in OWA. Fox sedge (*Carex vulpinoidea*) was found bordering the Thermalito Diversion Pool. Columbian watermeal (*Wolffia brasiliensis*) was found in a number of ponds in OWA. Ahart's paronychia (*Paronychia ahartii*) was along the margins of vernal pools south of Thermalito Forebay.

Nine special-status species were found in upland habitats around Thermalito Diversion Pool and/or lands around Lake Oroville (DWR 2004). These include Butte County calycadenia (*Calycadenia oppositifolia*), dissected-leaved toothwort (*Cardamine pachystigma* var. *dissectifolia*), Brandegee's clarkia (*Clarkia biloba* ssp. *brandegeae*), white-stemmed clarkia (*Clarkia gracilis* ssp. *albicaulis*), Mosquin's clarkia (*Clarkia mosquinii*), Butte County fritillary (*Fritillaria eastwoodiae*), cut-leaved ragwort (*Senecio eurycephalus* var. *lewisrosei*), Humboldt lily (*Lilium humboldtii* ssp. *humboldtii*), and shield-bracted monkeyflower (*Mimulus glaucescens*).

3.4.9.3 Noxious and Invasive Plant Species

Nearly all plant communities within the project area have invasive or noxious weed species as a component. The number of weed species and infestations are substantially greater in lower elevation riparian and wetland areas than in upland communities, especially where some disturbance is present. One hundred and eighty-seven (28 percent) non-native plant species were identified in the project area. Sixty-three species of noxious or invasive plant species listed by the California Department of Food and Agriculture and/or by the California Invasive Plant Council have potential to occur within the project area. Thirty-five of these species were found during the 2002-2003 surveys. Non-native species of greatest concern that invade riparian and wetland areas around the Thermalito Complex and within OWA include purple loosestrife (*Lythrum salicaria*), giant reed (*Arundo donax*), tree-of-heaven (*Ailanthus altissima*), scarlet wisteria (*Sesbania punicea*), pampas grass (*Cortaderia selloana*), edible fig (*Ficus carica*), and black locust (*Robinia pseudoacacia*). Non-native species of greatest concern that occur around Lake Oroville include skeleton weed (*Chondrilla juncea*), brooms (*Cytisus scoparius*, *Genista monspessulana*, and *Spartium junceum*), and Himalayan blackberry (*Rubus discolor*). Yellow starthistle (*Centaurea solstitalis*), mustard species, and non-native grass species occur throughout the project area.

Water primrose (*Ludwigia peploides*) is an aquatic plant species that occurs along the margins and backwaters of the Feather River. Both the native (ssp. *peploides*) and non-native (ssp. *montevidensis*) subspecies occur in the area. This perennial species grows in dense mats and has been increasing in abundance since the mid-1990s. This increase has caused adverse ecological impacts on several important fish and wildlife species in OWA.

3.4.9.4 Culturally Important Plant Species

Plants of cultural importance to local Native Americans (e.g., fiber plants such as cattail, bulrush, and medicinal plants) exist within the project area. A wide variety of native plants were used by the ethnographic Maidu, and many of these species remain of concern to the local Native American community. Members of the local Maidu community continue to pursue traditional practices involving native plants. These activities include basket making, which can involve the use of western redbud, various ferns, and fibrous plants such as cattail and bulrush. Plants used for food (e.g., California black oak) and those with medicinal qualities are also of interest to the Maidu. Elderberry shrubs were historically used for the creation of musical instruments such as "clappers." There is a continued desire in the community to have access to these kinds of plant materials for the continuation of these traditional practices in the project area.

Seventeen species or groups of plants were identified as being of particular cultural value to local Native Americans. Fourteen of these were found within the project area. An additional 43 species or groups of species were identified as important plant species, of which 32 were identified as occurring in the project area.

3.4.10 Cultural Resources

The following text provides an overview of the prehistoric, historical, and ethnographic settings of the project area. A detailed description of the prehistoric and historical context of cultural resources is provided in the Draft Oroville Facilities Cultural Resources Inventory Report (DWR 2003c). The Draft Ethnographic Inventory of Konkow Maidu Cultural Places (DWR 2003d) provides a thorough description of the ethnographic and ethnohistoric cultural context. The sections presented below are summarized from those reports.

3.4.10.1 Prehistoric Setting and Lake Oroville Cultural Chronology

A number of the major trends, themes, and issues characterizing the prehistory of Northern California are manifest in the prehistoric archaeological record of the Feather River–Lake Oroville area. Prehistoric archaeology in this region has focused on delineating archaeological contexts, examining past lifeways, and studying cultural process. Relevant research topics associated with the former include consideration of paleoenvironment, site-formation processes, and cultural chronology. Not surprisingly, chronological issues and resultant culture-historical reconstruction have dominated much research in the Feather River–Lake Oroville region. Issues related to determination of past lifeways—including technology, subsistence-settlement, social organization, demography, and ideology/religion—have been explored much less. Questions concerning cultural process have dealt mainly with the nature of gatherer-hunter adaptations; models derived from a so-called "political economy" have competed with those emerging from "behavioral ecology/resource intensification" perspectives (see Raab 1996 for definitions).

Prehistoric peoples of the Feather River area resided in an area containing a suite of habitats embedded within grassland, scrubland, deciduous woodland, and coniferous forest biomes. These peoples developed subsistence adaptations increasingly focused through time upon exploitation of fish (e.g, native slow-water species and anadromous salmonids), large mammals (e.g., elk, deer, pronghorn), and acorns. These were supplemented by a host of other plants and animals. Various technological innovations were intimately tied to subsistence, including changes in weaponry (e.g., the introduction of the bow and arrow, fishing facilities), milling equipment (e.g., the shift from mano/metate to mortar/pestle), and textile arts (e.g., the development of basketry).

Procuring resources was a primary goal of elaborately developed trade and exchange networks, which frequently transported goods over long distances (e.g., obsidian and marine-shell ornaments). Trade and exchange were one aspect of the increasing elaboration of social organization through time, and development of regional religions (e.g., the Kuksu cult). Forces affecting cultural change through time have been proposed to include localized population growth, in-migration of foreign peoples, and environmental change.

The basic outline of prehistoric cultural chronology in the project area and environs was first developed by Olsen and Riddell (1963) and later expanded and elaborated by Ritter (1968, 1970) and Kowta (1988).

The earliest securely dated archaeological complex in the Lake Oroville area is the Mesilla complex, which has been dated between ca. 3,000 and 2,000 years Before Present (BP). Kowta (1988) described this as the Butte County foothills variant of the regional Martis tradition. This was followed by the Bidwell complex (ca. 2,000–1,200 BP), the Sweetwater complex (ca. 1,200–500 BP), and the Oroville complex (ca. 500-150 B.P.). The Oroville Complex represents protohistoric Maidu-Konkow. The Kuksu religion was probably present in some form during this period. Political organization was very similar to the ethnographic pattern (i.e., tribelets), and population density reached its highest levels at this time.

A detailed cultural chronology discussion of the two regions adjacent to the Lake Oroville region, the Southern Cascades, and Northern Sierra Nevada regions is available in the Draft Oroville Facilities Cultural Resources Inventory Report (DWR 2003c).

3.4.10.2 Historical Context

The varied topography of the area encompasses mountain, foothill, and valley land. The several branches of the Feather River rise high in the Sierra Nevada and cut deep gorges as they drop in elevation several thousand feet to the Sacramento Valley. On the far northeastern frontier of Spanish, and then Mexican, California, the area was explored by the Spanish in the early 19th century and later exploited by fur trappers in the 1820s and 1830s. The latter incursion led to introduction of diseases that severely disrupted the indigenous society. The rancho period in northeastern California began in the 1840s, but it was soon interrupted, first by the American takeover of California and then by the Gold Rush.

The Feather River was a major gold-producing area, with all the social, economic, and environmental consequences found elsewhere in the mining West. The miners quickly outnumbered the small *Californio* and much larger indigenous population inhabiting the area and began to reshape the landscape. Foothills and valleys along the Feather River and between the Feather and Sacramento Rivers soon became a center for agriculture—first cattle, then wheat, and later fruit, rice, and other crops. The rise of agriculture to a preeminent position in the local economy was tied to the establishment of irrigation, including adaptation of water-delivery systems that were first developed for mining. In the 20th century, the area became a source of hydroelectric power and, later, of water for the southern part of the State.

3.4.10.3 Ethnographic Setting

Residents of the project area spoke closely related dialects of the Konkow language, which extended throughout the Northwest Maidu or Konkow territory. Konkow is a sister language to Maidu (Northeastern or Mountain Maidu) and to Nisenan (Southern Maidu). Together, these three languages comprise the Maiduan language family, classified as a member of the Penutian language stock (Shipley 1978).

The Konkow were organized in village communities in which a larger, major village provided the central ceremonial and political focus for several nearby affiliated villages. These communities incorporated 3–5 smaller villages, with a total population of approximately 200 people. Chiefs of these communities were known for leadership ability, wealth, and generosity (Dixon 1905; Kroeber 1925). Several such village communities have been identified in the general Oroville region, with some locations occurring within the project area (Rathbun n.d.).

Subsistence was based on a mixture of gathering, fishing, and hunting that occurred on a seasonal basis during the course of the year. Salmon, deer, acorns, and pine nuts were among the most important food items. Trade with neighboring tribes was used to supplement the locally available resource base, and to foster intertribal relationships. Elaborate ceremonies, including the Kuksu cult, were practiced during the fall, winter, and spring. The handgame, a traditional competitive gambling game, provided an important opportunity for social interactions with teams from neighboring communities.

The influx of Spanish colonists, trappers, early settlers, and cattle ranchers in the early 1800s introduced diseases and disrupted both the environment and certain traditional Native American practices. With onset of the Gold Rush in 1848, the Feather River was the site of intensive settlement and mining activities that severely affected the fishery and displaced Native American inhabitants. Some Native Americans began working for miners, ranchers, or settlers, but many were sent to the Nome Lackee reservation in Tehama County—only to return shortly thereafter because of poor conditions at the reservation (Jewell 1987). A second relocation of local Native Americans was undertaken in fall 1863, when almost 500 Indians were forced to march 100 miles across the Sacramento Valley to the Round Valley reservation (Hill 1978). Today, local traditions and festivals such as the Feather River First Salmon Ceremony are indications of the rejuvenation of traditional values, practices, and community involvement, including classes to renew the Konkow language and to teach basketmaking.

3.4.11 Geology and Geomorphology

Approximately 15 percent of the study area is within the Cascade Range geomorphic provence, extending from Lake Almanor to Lassen Peak. Rock types in this province include tuff, breccia, volcanic ash, lava flows, and lahars of basaltic to rhyolitic composition, ranging in age from Pliocene to Recent (Holocene). The remaining 85 percent of the study area lies within the Sierra Nevada geomorphic province, which includes granitic intrusions, andesitic magma flows, and breccia, basalt, metamorphic rocks, ultramafic rocks, and unconsolidated sedimentary deposits.

The Feather River below Lake Oroville flows through the Sacramento Valley, the north half of the Great Valley of California. The Great Valley basin is a narrow, elongated, northwest trending depression that is approximately 450 miles long and 40–70 miles wide. Rocks and sedimentary deposits in the basin, which range in age from Cretaceous to Recent, are part of the Great Valley geomorphic province. Below these deposits are upper Jurassic bedrock materials consisting of oceanic metamorphic and igneous rocks related to the Sierra Nevada.

Large landslides are common around Lake Oroville and along the North Fork Feather River, mostly in metamorphic rocks, as well as the Middle Fork Feather. Landslides in the project area result from a combination of steep topography and steeply dipping, highly faulted, thin-bedded and weakly metamorphosed seidments in a seismically active area.

The study area is part of the foothills fault system—a series of north to northwest-trending, east-dipping reserve faults formed during the late Jurassic Nevadan orogeny. Historic seismicity in the foothills fault system includes the 5.7 Richter magnitude Oroville earthquake that occurred on August 1, 1975, along the Cleveland fault; a magnitude 4.6 earthquake on May 24, 1966 near Chico; and a magnitude 5.7 earthquake on February 8, 1940, 20 miles east of Chico. In the Sacramento Valley, seismic activity during the Holocene has occurred along the Dunnigan Hills fault, the Willows fault, and the Great Valley fault.

Study areas upstream from Oroville Dam include the 4 main stems of the Feather River (West, North, Middle, and South) upriver as far as each tributary's first fish passage barrier above the reservoir, as well as 10 smaller tributary creeks (2^{nd} order or larger) that drain directly into the reservoir footprint. Soils in the tributary areas upstream from Oroville Dam are generally found along steeply sloping canyons and are derived from weathering of the parent rock material. The four main tributaries of the Feather River currently have significant sediment deposition wedges extending from the reservoir level upstream from 1 to 3 miles.

Soils in the study area downstream from Oroville Dam are generally found on slopes ranging from 0 to 2 percent and are generally derived from river alluvium from mixed rock sources. Some soils are also derived from sediment, or reworked sediment, deposited during the hydraulic mining days. The predominant soil types or textures in the Feather River floodplain are fine sandy loam, loamy sand, and loam and silt loam. Soils in the floodplain are conducive to agriculture; many areas of riparian floodplain and fluvial terraces have been converted to irrigated crops and orchards.

The Feather River meander belt (the winding of the stream channel in the shape of a series of loop-like bends) is constrained by terrace deposits of the Quaternary Riverbank and Modesto formations. The historic meander belt is more than 2 miles wide near Oroville, but narrows gradually to about 1 mile toward Marysville. Below Marysville and the confluence with the Yuba River, the meander belt again broadens, becoming more than 4 miles wide near the Sutter bypass. Channel bed composition varies in a downstream direction. The upper part of the river, from Oroville to Gridley, is mostly a combination of boulders, cobbles, and gravel. Below Gridley to the mouth, the substrate is mostly sand.

The Feather River has been affected by a number of human-induced events, including hydraulic mining, flow diversions, dam construction, levees, dredging, and vegetation manipulation (agriculture, timber harvesting, etc.). Of these, hydraulic mining, the presence of Oroville Dam, and flood control levees have had the most significant effects on stream geomorphology.

Hydraulic mining initially caused an initial surge of fine sediment into the channels, which was followed by large inputs of coarse debris generated from mining coarser gold-bearing deposits. These materials buried the river channel to depths of more than 100 feet. The channel degradation process began immediately after the end of the mining era. In the steep canyons of the upper Feather River, the deposits were washed downstream, leaving only a few high terrace remnants. Ninety percent of the debris still remains as a virtually permanent deposit of cobbles, gravel, sand, silt, and clay deposited on the banks and floodplain.

The following are a few characteristics of the present-day Feather River as a result of effects from a number of related actions (including mining, levee and dam construction) that will be further assessed in the January 2005 PDEA:

- An increase in bank stability and reductions in bank erosion.
- Reductions in the interaction between the stream and its floodplain.
- Decreased meander rates, gravel recruitment, and downstream sediment transport.
- Entrenchment of the river. The channel thalweg has been scoured down as much as 6 feet, and the cross-sectional area increased by as much as 250 percent between 1909 and 1970.

3.4.12 Land Use, Management, and Planning

Land use within the FERC boundary and study area is diverse. The lands are owned and managed by a number of entities, have various management directions, and support an assortment of land uses (Figure 3.4.12-1). The lands within the FERC boundary comprise approximately 41,100 acres, whereas the study area (area within the FERC boundary and an additional 0.25 mile) comprises approximately 70,500 acres. Eight major types of land use occur in the FERC boundary and the study area. Within the FERC boundary, the distribution of land use classification is greatest for reservoir/open water (46.4 percent) and recreation (31 percent). Other land use classifications include conservation (18.3 percent), undeveloped/habitat (2.5 percent), urban (1.2 percent), other (0.4 percent), resource extraction (0.1 percent), and rural (0.1 percent). The most common land use category in the study area is reservoir/ open water (27.6 percent), followed by undeveloped/habitat (26.4 percent), recreation (19.6 percent), conservation (17.7 percent), rural (3.7 percent), urban (3.3 percent), other (1 percent), and resource extraction (0.7 percent).

The entities that manage lands in the study area have developed land management plans that control existing land uses and give direction to future land uses within their jurisdictions. The federal government owns and manages 16 percent of the approximately 70,500-acre study area. The two federal agencies primarily responsible for managing these lands are the USFS and the BLM. The State of California owns 52.3 percent of the lands in the study area. These State-owned lands are managed primarily by DWR, DFG, and DPR. Privately owned lands constitute 29.4 percent of the lands in the study area. Lands owned by Butte County (County), the City of Oroville (City), the Feather River Recreation and Park District (FRRPD), and other local districts/agencies together account for 0.6 percent of the land in the study area.

The lands within the approximately 41,100-acre FERC boundary are owned and managed by either the federal or State government. The land management direction for most of the land within the FERC boundary is much more restricted. It includes recreation, natural resource conservation, and public facilities land uses.

Federal lands account for 15.2 percent of land within the FERC boundary, and State lands account for 84.8 percent of the land. USFS and BLM have primary management responsibility for federal lands within the FERC boundary. Whereas DWR is responsible for the State-owned lands within the FERC boundary, DWR, DPR, and DFG all have management responsibilities for these lands. Pursuant to the Davis-Dolwig Act, the properties and management responsibilities of each agency for lands within the FERC boundary are detailed in a series of Resource Agency Orders and agreements among the agencies involved. Therefore, the State of California holds fee-title ownership to all State lands within the FERC boundary, and DWR is considered the “maintaining” or “controlling” agency, but large areas are managed by DWR, DPR, and DFG. DPR, with input from DWR, is charged with designing, constructing, operating, and maintaining public recreation facilities. DFG, with input from DWR, is responsible for managing fish and wildlife resources.

As a result, DWR has primary management responsibilities for approximately 5 percent of the lands within the FERC boundary. Despite the agreements with DPR and DFG on some management duties, DWR still bears the ultimate responsibility under the current FERC license for ensuring funding, development, and management of current and additional recreation facilities.

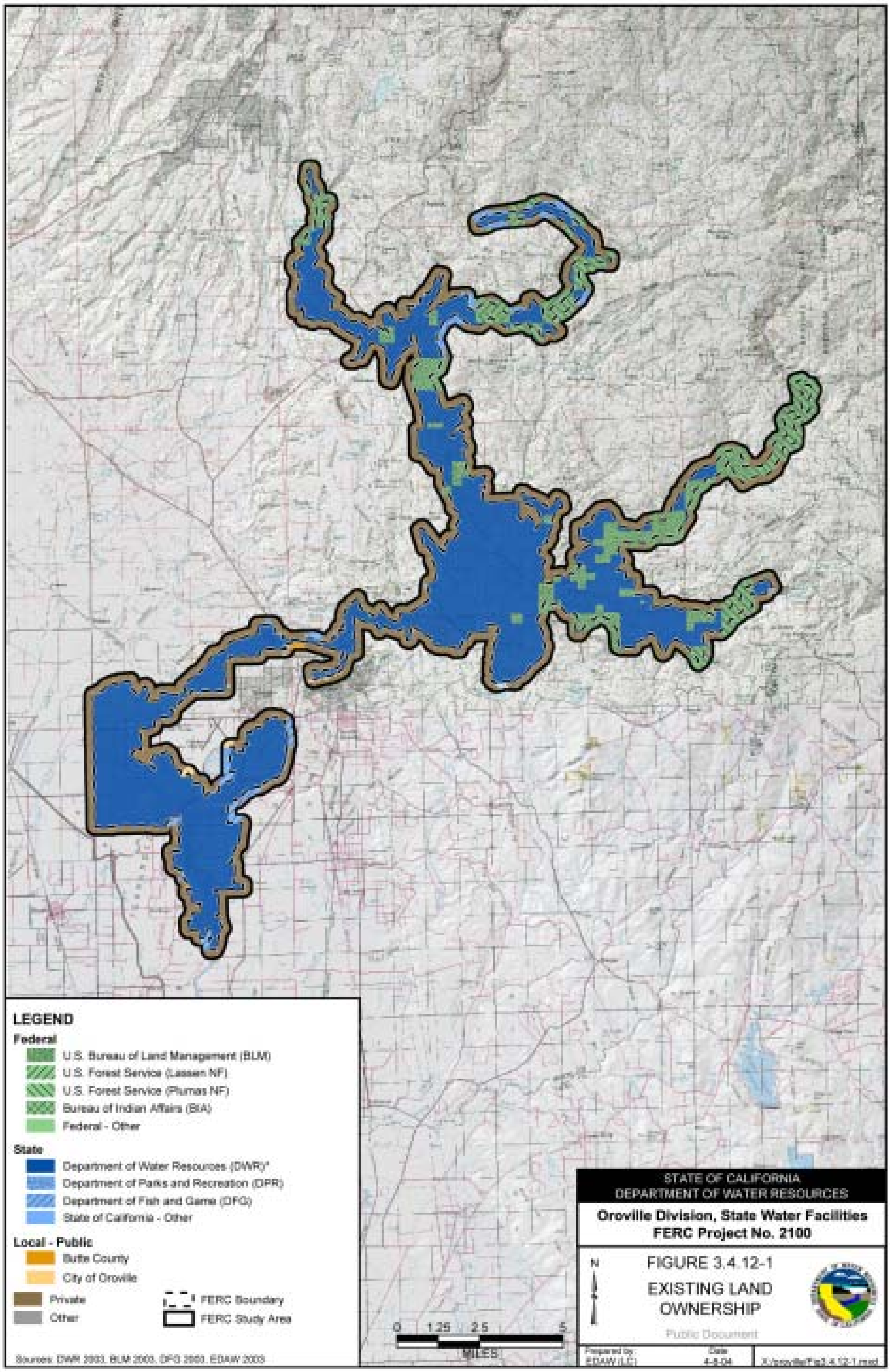
3.4.13 Noise

The State of California has adopted noise standards in areas of regulation not preempted by the federal government. State standards regulate noise levels of motor vehicles and freeway noise affecting classrooms and other sensitive receptors, set standards for sound transmission control and occupational noise control, and identify noise insulation standards. The State has also developed land use compatibility guidelines for community noise environments. The City of Oroville (City) has adopted noise standards for land use compatibility that are similar to those recommended by the State of California. The City has also adopted maximum allowable noise exposure standards for both non-transportation and transportation noise sources, as well as significance thresholds for predicted increases in cumulative ambient noise exposure levels. Butte County (County) has not adopted noise standards for determination of land use compatibility or maximum allowable noise exposure levels for noise-sensitive receptors.

Noise sources in the area consist primarily of vehicle traffic on nearby roadways and recreational boating activities on area waterways. Ambient noise levels in the vicinity of Lake Oroville are typically low (e.g., less than 50 A-weighted decibels [dBA] equivalent noise level [L_{eq}]), although noise associated with recreational watercraft is detectable at some nearby areas. Noise-sensitive receptors in the vicinity of Oroville Dam include the OWA and various residential dwellings.

3.4.14 Paleontological Resources

Paleontological resources consist of fossils and fossil-bearing geologic formations. Fossils are the remains, traces, and imprints of plants and vertebrate or invertebrate animals. Fossils include lithified or mineralized remains that preserve structural characteristics of organisms, as well as trace fossils such as molds, casts, tracks, trails, and burrow impressions. Paleontological resources are important for their past and future potential contribution to the scientific understanding of geological history, paleoclimatology, paleogeography, and the evolution of life on Earth. The study area contains a variety of paleontological resources and unique geological formations.


LEGEND
Federal
U.S. Bureau of Land Management (BLM)
U.S. Forest Service (Lassen NF)
U.S. Forest Service (Plumas NF)
Bureau of Indian Affairs (BIA)
Federal - Other
State
Department of Water Resources (DWR)*
Department of Parks and Recreation (DPR)
Department of Fish and Game (DFG)
State of California - Other
Local - Public
Butte County
City of Oroville
Private
Other
FERC Boundary
FERC Study Area
Sources: DWR 2003, BLM 2003, DFG 2003, EDAW 2003
0 1.25 2.5 5
MILES
N
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
FIGURE 3.4.12-1
EXISTING LAND OWNERSHIP
Public Document
Prepared by: EDAW (LC)
Date 4-8-04

Almost all fossils are found in sedimentary deposits. Intrusive igneous rocks never came into contact with organisms, and the extreme heat of extrusive igneous materials usually incinerates or vaporizes organic material. The only exception to this is in regard to cooled volcanic ash or mudflows. Metamorphic rocks rarely contain recognizable fossil materials, due to modification by heat and pressure, but lightly metamorphized rock may include fossils.

Within the study area, the oldest fossils are found in slightly metamorphized marble, known as the Calaveras Limestone; these are clamshells that are probably no younger than Permian (>248 million years before present [MYBP]) in age. The Calaveras Limestone is exposed in West Branch Canyon.

One rare find of a fossil ammonite, Jurassic (>145 MYBP) in age, is the only indication of paleontological materials in the Oregon City Formation, a slightly metamorphized deposit of volcanic/volcaniclastic rock (metavolcanics) found in the study area from lower West Branch Canyon south to and beyond the Thermalito Diversion Pool, and also beneath the peninsula across from the Goat Ranch Recreational Area.

At least ten genera of plant fossils, including ferns, cycads, and gingkos, are found in the Monte del Oro Formation, a lightly metamorphized deposit of marine sediment of Middle Late Jurassic age which is exposed at the Thermalito Diversion Pool.

The Chico Formation, a deposit of Late Cretaceous (>65 MYBP) sandstone, is exposed a short distance from the West Branch Canyon. North and west of Oroville, it has produced numerous vertebrate and invertebrate fossils.

The Middle Eocene (>34 MYBP) Ione Formation includes a variety of sediments, ranging from volcanic ash and mudflows to stream-deposited gravels. Exposures of the Ione Formation occur in the Thermalito Diversion Pool and the Thermalito Forebay, and near South Table Mountain. The Ione Formation has produced numerous plant fossils (wood and leaves) as well as invertebrate fossils, burrows, and tracks.

The New Era Formation, a deposit of Late Miocene (>5.3 MYBP) fluvial sediment, has produced at least one vertebrate fossil find. The New Era Formation is exposed just outside of the FERC boundary, around the New Era Mine near the north end of Dry Creek.

Fossil leaves and cones have been found in the Tuscan Formation, a deposit of volcanic ash dating to >3 MYBP during the Pliocene Epoch. The Tuscan Formation is exposed in West Branch Canyon, and at Johnson Hill and a nearby ridge. Vertebrate fossils, including camel and mammoth, have been found in gravels that may be part of the Tuscan Formation or may be later (Pleistocene) in age.

Late Cenozoic Gravels (including deposits of sand and clay), ranging from 9,000 years BP to >3 MYBP, are variously assigned to the Laguna, Riverbank, or Modesto

Formations. Exposures of these formations are common in the project area at Oroville Dam, downstream of the Thermalito Diversion Pool, and elsewhere. The only vertebrate fossils known from the project area were found at the Thermalito Diversion Pool and Thermalito Afterbay, but numbers of vertebrate remains have been found in other Late Cenozoic Gravels in the region.

The most significant fossil-bearing formations within the project area are the Calaveras Limestone, the Monte del Oro Formation, the Chico Formation, the New Era Formation, and the Late Cenozoic Gravels. These are ranked as "C1" formations, according to BLM criteria, because they are known to contain vertebrate fossils or noteworthy examples of invertebrate or plant fossils.

Also considered significant within the project area are portions of the Ione Formation and the Tuscan Formation. These are ranked as "C2" formations, according to BLM criteria, because they have the potential to contain vertebrate fossils or noteworthy examples of invertebrate or plant fossils.

Other rock formations exposed within the study area are not expected to contain fossils due to their mostly igneous or metamorphic nature. These are ranked as "C3" according to BLM criteria. They include Jurassic serpentine, metasediments, and metavolcanics; the Smartville Ophiolite; the granitic Bedrock Series of Cretaceous age; the Early Miocene Lovejoy Basalt; portions of the Ione Formation; and recent sediments.

3.4.15 Public Services

Several federal, State, and local agencies have public service responsibilities in the study area. FERC is the major federal regulatory agency responsible for regulating hydroelectric dams. As a part of relicensing, FERC requires that dam safety be addressed. The USFS is a federal land management agency within the U.S. Department of Agriculture. Plumas National Forest (NF), which is part of USFS, manages parcels of land in the eastern portion of the study area. Plumas NF has no formalized patrols in the study area, but does respond to calls for additional support. The BLM is a federal land management agency within the U.S. Department of the Interior and is responsible for managing 261 million acres, primarily in the western United States. BLM has lands within the study area administered by the Redding Field Office; BLM collaborates with State agencies (DPR and DWR) and allows them to patrol BLM–managed lands within the study area.

DPR is the primary responsible agency for managing and patrolling recreation sites in the LOSRA, including Lake Oroville and Thermalito Forebay. DPR conducts boat patrols at Lake Oroville and Thermalito Forebay as well. Boat patrols take place on the weekends during peak and shoulder seasons, and sporadically during the weekdays during these time periods. Currently, there are 11 State Park Rangers and 2 Supervising State Park Rangers at LOSRA.

DFG is the primary State agency responsible for the management of fish and wildlife in California. DFG is responsible for law enforcement within the OWA, which includes Thermalito Afterbay and the portion of the Feather River that flows through OWA. There is one DFG Game Warden to patrol DFG–managed lands in Butte County.

Contracted security officers patrol DWR facilities and buildings, as well as land-based recreation sites at Thermalito Afterbay. DWR also operates an Area Control Center near Oroville Dam that coordinates operations and generation activities related to the project. The center operates 24 hours a day and coordinates patrols and security at the field level.

The California Highway Patrol (CHP) is responsible for patrolling two State-managed highways in the proximity of the Oroville Facilities, SR 70 and SR 162. With the exception of the DPR lands, the CHP is also responsible for patrolling all State-managed lands, such as the Oroville Dam and powerhouse.

The CDF has a mission to protect the people of California from fires, respond to emergencies, and protect and enhance forest, range, and watershed values providing social, economic, and environmental benefits to rural and urban citizens. CDF has major fire-related responsibilities within the study area, including firefighting and prescribed burning. CDF also often serves as a first responder to accidents in the study area and provides assistance and mutual aid on search-and-rescue operations.

Under contract with DWR, the County Sheriff’s Office is also responsible for patrolling the waters of Thermalito Afterbay. The Butte County Sheriff has also periodically patrolled Lake Oroville, and portions of the Feather River within OWA are part of their jurisdiction.

The Oroville Police Department is responsible for public safety within the city limits of Oroville. The Oroville Police Department has 25 full-time officers. The department has law enforcement jurisdiction along the Feather River between the Thermalito Diversion Pool and OWA. The department performs patrol duties on lands adjacent to project facilities. These patrols often involve issuing citations for vehicle mechanical violations, problems with vehicle trailers, or alcohol use. The department also provides additional support during incidents at project facilities.

3.4.16 Public Health and Safety

Public health and safety refers primarily to issues that may affect the well-being of those living within, or using the various resources of, the Oroville Facilities project area. Potential public health and safety issues in the Oroville Facilities project area include:

- Public health–related water quality impacts from commercial, residential, and recreation-related wastewater and sewage, which may foster waterborne diseases and illnesses, such as those from the presence of coliform bacteria;

- Contaminants and toxic substances found in water, soils, and sediments, which may be from natural sources in the project area and upstream areas that have moved into the project area;
- Vectors, principally mosquitoes found in the project area waterways and standing water sources, but also other vectors that may affect public health, such as rats and wildlife species that have contracted rabies. The level of concern has risen recently because of the potential migration of the West Nile virus to California, and because of the preponderance of waterways and standing water—particularly in the regionally located rice fields—Butte County has its own mosquito abatement district;
- Hazardous materials, such as fuels, oils, and chemicals used by DWR and commercial entities within the project area;
- There are current and former gasoline station sites within the project area, and there has been unauthorized dumping of solid (and hazardous) wastes in the project area, most notably in the OWA;
- Flooding, landslide, and seismic–related hazards, as localized flooding has occurred historically in and around the project area, and the Oroville region is known as being seismically active; and
- Wildfires, particularly at the urban/wildland interface. This interface is most pronounced within the project area around Kelly Ridge; however, there have been numerous small and large wildfires in the project area in historic and recent times, particularly in and around OWA. A significant wildfire occurred in 2001 in OWA that was fanned by high winds and swept through the Oroville industrial area along the east side of SR 70.

3.4.17 Recreation

3.4.17.1 Recreational Resources in the Region and Project Vicinity

The Oroville Facilities are located in a region that is diverse in natural resources and provide a wide array of outdoor recreation opportunities. The following areas are within a 1- to 2-hour drive of the Oroville Facilities:

- *Lassen NF:* Approximately 40 miles north of Lake Oroville, Lassen NF provides 1.2 million acres of diverse natural resources, ranging from low-elevation chaparral and oak hills to conifer forest–covered volcanic peaks. The forest has numerous developed campgrounds and three designated Wilderness Areas. Numerous trailheads provide access to many miles of trails for hikers, bicyclists, and equestrians, including 58 miles of the Pacific Crest Scenic Trail, which extends from Mexico to Canada.

- *Lassen Volcanic National Park:* Surrounded by Lassen NF, the park is approximately 100 miles north of the project area. The park covers 106,000 acres of forested foothills and the 10,000-foot Mount Lassen, and offers hiking, camping, fishing, and sightseeing in an active volcanic landscape. A museum provides information on the historical, cultural, and natural aspects of the park. Park roads and most facilities are closed during winter due to heavy snow cover.
- *Lake Almanor:* Lake Almanor, approximately 50 miles northeast of the Oroville Facilities, is one of the largest man-made lakes in California, providing a maximum of 28,000 acres for boating, fishing, and other water recreation. The reservoir is at an elevation of 4,500 feet and is surrounded by pine forests and several small communities offering lodging and other commercial services. The reservoir is a part of the Upper North Fork hydropower project operated by Pacific Gas and Electric Company (PG&E), which, with Lassen NF, has developed a number of family and group camping, picnicking/day use, and boating facilities within the Lake Almanor Recreation Area on the west shore of the reservoir. A 9-mile paved trail popular with bicyclists runs the length of the Recreation Area.
- *Butt Valley Reservoir:* Butt Valley Reservoir, 4 miles south of Lake Almanor, is also part of PG&E's Upper North Fork project and provides similar recreation opportunities in a less-developed setting. The reserevoir has 1,600 surface acres at maximum pool level. PG&E has developed two campgrounds on the east shore of the reservoir, as well as a boat launch and day use facility. A Plumas County ordinance limits boat speeds to 25 mph.
- *Plumas NF:* The 1.2 million-acre Plumas NF extends across the northern Sierra east of Lake Oroville. The forest contains three reservoirs between 1,600 and 4,000 acres in area, each with developed facilities for fishing, boating, camping, and swimming, and many small alpine lakes as well. The forest also provides visitors more than 300 miles of trails, including 75 miles of the Pacific Crest Trail.
- *Bucks Lake Recreation Area:* The primary features of the Bucks Lake Recreation Area, approximately 20 miles northeast of the Oroville facilities, are 1,800-acre Bucks Lake and 250-acre Lower Bucks Lake, immediately below Bucks Lake Dam. Although much of the shoreline of Bucks Lake is privately owned, PG&E and Plumas NF have developed several small family campgrounds and one group campground on the reservoir. Lower Bucks Lake has a single RV campground. Four boat ramps provide access to the water for boating, water-skiing, and fishing. Three resorts provide lodging, restaurants and bars, and supplies.
- *North Fork Feather River Hydroelectric Projects:* PG&E operates three hydroelectric developments on the North Fork of the Feather River between Lake Almanor and Lake Oroville—the Rock Creek, Cresta, and Poe Projects. Each project includes a small reservoir of less than 150 acres, with no developed facilities. PG&E provides facilities for river access, camping, and picnicking and

a highway rest stop near the Cresta Reservoir. Plumas NF provides three small campgrounds along the river.

- *Feather River Scenic Byway*: The byway, dedicated by the USFS in 1998, follows SR 70 from the north end of Lake Oroville up through the gorge of the North Fork of the Feather River. Travelers enjoy spectacular views and many points of cultural, geologic, and historical interest along the 130-mile route.
- *Feather Falls Scenic Area:* Plumas NF manages this 15,000-acre area, which features the Feather Falls National Recreation Trail. The trailhead is approximately 20 miles east of Oroville. The 9-mile loop trail leads to Feather Falls, at 640 feet the sixth highest waterfall in the contiguous United States and fourth highest in California. The trail also provides excellent views across the Canyon of the Middle Fork Feather River to Bald Rock Dome, a large barren granite dome that rises above the canyon and dominates the scenery for miles around.
- *Gray Lodge Wildlife Area:* This area is approximately 20 miles south of the Oroville Facilities, and features 8,400 acres of wetlands managed by DFG primarily for shorebirds and waterfowl. Hundreds of thousands of migratory ducks and geese use the area during fall and winter. Winter and fall hunting and year-round wildlife viewing are the primary recreation activities. A museum, wildlife viewing platform, and informative exhibits are provided for visitors.

3.4.17.2 Recreation Resources in the Project Area

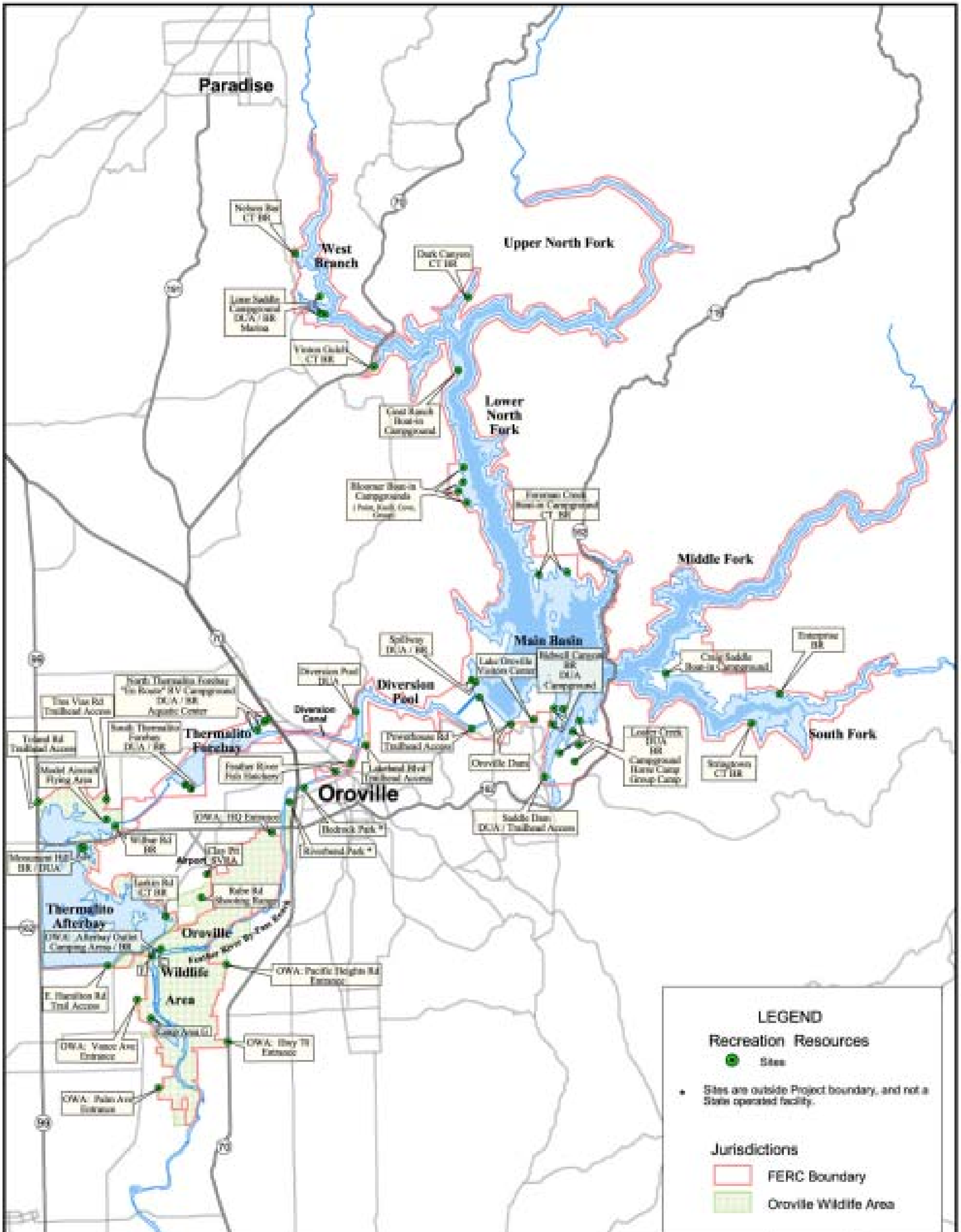
The existing Oroville Facilities host a wide variety of recreation opportunities. The major components of the Oroville Facilities that host recreation are Lake Oroville, the Thermalito Diversion Pool, Thermalito Forebay, Thermalito Afterbay, and the OWA (see Figure 3.4.17-1). The recreation facilities and amount of visitor use for each reservoir and other components of the project area are described below.

Lake Oroville

Lake Oroville is one of the largest reservoirs in California, with 15,000 surface acres and 167 miles of shoreline at full pool. The reservoir elevation fluctuates more than 100 feet, on average, each year and can fluctuate 150 feet or more some years. The amount of fluctuation depends largely on the amount of winter precipitation in the watershed and resulting spring inflow into the reservoir.

A large percentage of the recreation lands and facilities surrounding the reservoir are part of LOSRA, managed by DPR. There are major recreation facilities at Lime Saddle, Spillway, Bidwell Canyon, and Loafer Creek.

The Lime Saddle Recreation Area is located on the western shoreline of the West Branch of the North Fork arm of the reservoir. The area contains a five-lane boat ramp with parking for several hundred vehicles and boat trailers, picnic sites, a fish cleaning station, and restrooms.



Source: DWR GIS / EDAW 2003

1 0 1 2 3 4 5 6 Miles

Scale 1 : 142,560
1" = 2.25 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Division, State Water Facilities
FERC Project No. 2100

Figure 3.4.17-1
Project Area and Associated Recreation Sites

Public Document

Prepared by: PJ – EDAW, Inc. Date: 4/1/04

A concessionaire-operated full-service marina is adjacent to the ramp that provides long- and short-term moorage and covered and open dock slips. The marina also offers boat rentals, gas, a pump-out station, and a general store with bait and tackle and convenience goods. A new 50-site campground with restrooms and showers, constructed on a peninsula across from the boat ramp and marina, opened in July 2001.

The recently improved Spillway Recreation Area is located adjacent to the Oroville Dam spillway, at the north end of the dam and at the southwest corner of the reservoir. The area contains the largest boat launching facility on the reservoir, with ramps and parking areas at two levels to accommodate seasonal water level changes. The upper level ramp has 12 lanes with 3 floating docks and a parking area providing space for 350 vehicles with boat trailers and more than 100 single vehicles. The area also has a restroom and shaded picnic tables overlooking the reservoir. Self-contained RVs can use a portion of the upper parking lot for overnight stays.

Bidwell Canyon is a major recreation area at the southern end of the reservoir, with a campground hosting both tent and RV camping, a small day use area centered around a relocated historic bridge and tollhouse, and a 7-lane boat ramp with parking for more than 200 vehicles and boat trailers. The area also contains the concessionaire-operated full-service Bidwell Marina, which, like Lime Saddle Marina, provides long- and short-term moorage and covered and open dock slips. The marina also offers boat rentals, gas, a pump-out station, and a general store with bait and tackle and convenience goods, and a restaurant/bar.

The Loafer Creek Recreation Area is the largest and most diverse recreation complex on the reservoir, and is located directly across Bidwell Cove from the Bidwell Canyon facilities. Within this complex is a family campground, several group campgrounds, a horse camp, a day use beach and picnic area, a boat ramp, and a network of trails. The horse camp is a specially built facility for equestrians, with a horse washing station and horse tethering and feeding stations near each campsite. The large day use area has 80 picnic tables and numerous barbecue grills surrounding a swim beach with bathrooms and showers. The seasonal, 8-lane boat ramp has a floating dock and parking for nearly 200 vehicles and trailers. Several trails for hiking, biking, and horse use loop through the area and link to all three camp areas and the day use area.

Other boat launching facilities include a seasonal two-lane ramp on the South Fork arm of the reservoir at Enterprise and five car-top boat ramp areas scattered across several areas of the reservoir that provide for small-boat access to the water. Also, camping boaters have access to four primitive boat-in camp areas with designated tent sites, and several floating campsites anchored in different areas of the reservoir. The floating campsites are two-story structures with tent/sleeping space, gas grills, a table, sink, restroom, and storage area. Seven two-stalled floating toilets around the reservoir provide for the sanitary needs of boaters.

The Lake Oroville Visitors Center, situated on Kelly Ridge between Oroville Dam and the Bidwell Canyon area, features exhibits on the engineering and construction of the hydropower facilities including the dam and explains how the Oroville Complex distributes water and electrical power to its destinations. There are also interpretive displays on the native culture and the natural resources of the area. A 47-foot viewing tower provides a panoramic view of the reservoir and its surroundings. Shaded picnic areas are provided nearby.

Visits to Lake Oroville during the 12-month period of May 15, 2002 to May 14, 2003, including the visitors center, totaled more than 915,000 recreation days (RDs). The percentage breakdown of this use by major activities includes boating (including fishing from a boat), 45 percent; sightseeing or pleasure driving, 25 percent; picnicking, 7 percent; bank fishing, 5 percent; and swimming, 4 percent.

Thermalito Diversion Pool

The Thermalito Diversion Pool consists of a 4.5-mile stretch of the Feather River from Oroville Dam to Thermalito Diversion Dam. The pool covers 320 acres, rests between steep wooded hillsides, and provides opportunities for visitors to enjoy quiet, uncrowded conditions.

The gravel Burma Road runs alongside about 1 mile of the west shoreline and provides access to the pool for anglers and car-top boaters. Only non-motorized boats are allowed on the Thermalito Diversion Pool. The only facility provided is a vault toilet. The road terminates at a trailhead where hikers, bicyclists, and equestrians can access the Brad P. Freeman Trail, which follows the north shoreline of the Thermalito Diversion Pool before climbing to Oroville Dam. The Brad P. Freeman Trail also follows the opposite shore, running on an old railroad bed. The Dan Beebe Trail winds through the hillsides just above. The Lakeland Boulevard Trailhead Access sits above Thermalito Diversion Dam on the south side of the Thermalito Diversion Pool and provides access to both trails.

Visits to the Thermalito Diversion Pool during the 12-month period of May 15, 2002 to May 14, 2003 totaled about 20,000 RDs, the least of any of the project areas. The percentage breakdown of this use by major activities includes trail use, 50 percent; bank fishing, 21 percent; sightseeing or pleasure driving, 14 percent; picnicking, 11 percent; and boating, 5 percent.

Thermalito Forebay

Thermalito Forebay is a 630-acre hour glass-shaped reservoir that is divided into north and south halves where the pool constricts into a narrow channel at the Nelson Road bridge crossing. Only non-motorized boats are permitted on the North Forebay, which is popular for small sailboats. The east end of the pool is the site of the 300-acre North Forebay Day Use Area (DUA), the most popular day use site in the project area. The North Forebay DUA features a large sandy beach and swim area on a shallow lagoon connected to the forebay. The large picnic area adjacent to the beach provides more than 100 picnic tables, many under shade structures, dispersed across a tree-shaded lawn. The picnic area is suitable for family or large group picnics, and has both restrooms and pit toilets. A paved trail encircles the swim lagoon, and the Brad P. Freeman Trail passes through the site. On the main body of Thermalito Forebay within the North Forebay DUA are two boat ramps, and the Aquatics Center. The Aquatic Center is a 1,200-square-foot boat storage facility historically operated by a local sailing club for sailing events and instruction.

The South Forebay DUA at the opposite end of the pool includes a boat ramp with floating dock, several shaded picnic sites, and a fish cleaning station. The South Forebay DUA is open for motorized boating.

Visits to Thermalito Forebay during the 12-month period of May 15, 2002 to May 14, 2003 totaled nearly 136,000 RDs. The percentage breakdown of this use by major activities includes picnicking, 32 percent; bank fishing, 24 percent; swimming, 23 percent; and boating, 10 percent.

Thermalito Afterbay

Thermalito Afterbay is a shallow reservoir at the southwest corner of the project area covering 4,300 acres at maximum operating storage. Unlike Lake Oroville, the elevation of Thermalito Afterbay fluctuates during much of the year on a weekly cycle, with 5–6 feet of elevation change during a typical week. The pool is raised during the week and drawn down over the weekend, as dictated by hydropower operations.

There are opportunities for a variety of recreational activities at Thermalito Afterbay. There are three boat launch facilities on the eastern shore used by pleasure boaters, anglers, and hunters. The Wilbur Road BR near the north end of the pool provides two launch lanes with a floating dock, a pit toilet, and paved parking area. The Monument Hill BR/DUA also provides two launch lanes and a floating dock, along with a small sand beach with picnic tables. This area is popular with PWC riders, as well as water-skiers who frequently use the water-ski slalom course. The site also has a restroom, picnic sites, and a fish cleaning station on a hill overlooking the ramp area. The Larkin Road Car-top BR is on the southern portion of Thermalito Afterbay and provides a low-gradient paved ramp used to launch PWC riders and other small boats, and a pit toilet.

Thermalito Afterbay is managed by DFG as part of the OWA. Brood ponds to support waterfowl reproduction have been constructed at several areas near shore on the north and east sides of the pool. Hunting occurs on the area during the fall and winter, primarily for pheasant and waterfowl. Hunting blinds have been installed at various points along the shoreline. Hunters access the area at several road-end trailheads, as well as at the boat ramps.

Visits to Thermalito Afterbay during the 12-month period of May 15, 2002 to May 14, 2003 totaled about 93,000 recreation days. The percentage breakdown of this use by major activities includes boating (including PWC use and boat fishing), 57 percent;

swimming, 21 percent; picnicking, 13 percent; sightseeing, 4 percent; and bank fishing, 4 percent.

Oroville Wildlife Area

OWA, not including the afterbay portion described above, consists of about 5,000 acres of lands on both sides of the Feather River, a large part of which is covered with cobble spoil piles from historic gold dredging in the river. There are numerous small willow and cottonwood–lined ponds in areas where this material has been removed. The area is adjacent to or straddles 12 miles of the Feather River.

The river draws most visitors to the site, in particular its steelhead and salmon fishery. The most visited site in the area is the well-known Thermalito Afterbay outlet area, where Thermalito Afterbay releases water into the river. During the peak of the steelhead and salmon seasons, the site is very heavily used by anglers from throughout the region; visitor facilities are limited to a vault toilet and a primitive camping area. The only other OWA facilities are several unpaved and informal boat launch sites along the west bank of the river. The ponds in the area draw waterfowl hunters during the fall hunting season. Access to the river and the ponds is by gravel roads that run atop the riverside levees and old railroad embankments through the area.

Visits to OWA (not including Thermalito Afterbay) during the 12-month period of May 15, 2002 to May 14, 2003 totaled about 318,000 RDs. The percentage breakdown of this use by major activities includes bank fishing (which includes wading), 67 percent; sightseeing, 12 percent; boating, 8 percent, and picnicking, 7 percent.

3.4.18 Socioeconomics

Following is a brief overview of the socioeconomic characteristics of the affected environment, as represented by population, employment, income, and fiscal conditions in Butte County.

3.4.18.1 Population Characteristics and Trends

Butte County's population totaled an estimated 207,000 in January 2002, including 93,300 residents in the unincorporated areas of the county (California Department of Finance 2002). The county's largest city is Chico (population 66,800), followed by Paradise (26,500), Oroville (13,000), Gridley (5,600), and Biggs (1,800). Between 1960 and 2000, the population of Butte County increased by about 250 percent, exceeding the growth rates of all its neighboring counties. In the last 20 years, however, Butte County's 2.1 percent annual growth rate has fallen behind the State average and is slower than the rates for most other Sacramento Valley counties. Much of the population growth in the incorporated areas of Butte County since 1960 has occurred in Chico, which owes a large part of its growth to annexation.

With the exception of Biggs and Gridley, which have relatively large populations of Hispanics, the populations of Butte County and its communities are largely white (Table 3.4.18-1). Countywide in 2002, whites accounted for 84.5 percent of the population, while Hispanics accounted for 10.5 percent.

Table 3.4.18-1. Existing Butte County population and racial distribution.

	Butte County	Biggs	Chico	Gridley	Oroville	Paradise
Population						
	207,000	1,800	66,800	5,600	13,000	26,500
Race as a Percentage of Total Population						
White	84.5%	74.5%	82.4%	66.6%	77.2%	93.7%
Black or African American	1.4%	0.4%	2.0%	0.3%	4.0%	0.2%
American Indian or Alaska Native	1.9%	1.8%	1.3%	1.5%	3.9%	1.1%
Asian	3.3%	0.8%	4.2%	3.5%	6.3%	1.0%
Native Hawaiian or Pacific Islander	0.1%	0.0%	0.2%	0.0%	0.3%	0.1%
Other Race	4.8%	18.5%	5.7%	24.1%	2.8%	1.2%
Two or More Races	3.9%	3.8%	4.3%	4.0%	5.4%	2.6%
Hispanic of Latino of Any Race	10.5%	27.6%	12.3%	38.6%	8.3%	4.3%

Note: Percentages for each area total to greater than 100% because persons of Hispanic or Latino heritage may be considered members of other racial classifications.
Source: U.S. Census Bureau 2002 (2000 Census Data), California Department of Finance 2002

3.4.18.2 Employment and Personal Income

In 2001, total wage and salary employment in Butte County averaged approximately 74,200 jobs. The county's unemployment rate averaged 7.1 percent in 2001, which was substantially higher than California's 5.4 percent rate (California Employment Development Department 2003a). Locally, unemployment rates in Gridley (12.9 percent), Oroville (10.7 percent), and Biggs (10.5 percent) were higher than the countywide average. Unemployment rates in Paradise and Chico were relatively low, at 5.5 percent and 6.8 percent, respectively (California Employment Development Department 2003b). Employment within the county has increased at an average annual rate of 2.0 percent since 1990. Key employment sectors in Butte County include government (22.3 percent of employment), educational and health services (15.2 percent), and retail trade (13.3 percent).

Personal income received by persons residing in Butte County totaled approximately $4.7 billion in 2001, resulting in per capita income of $22,820 (U.S. Bureau of Economic Analysis 2003).

3.4.18.3 Fiscal Conditions

Public services in the incorporated areas of Butte County are provided by the governments of Biggs, Chico, Gridley, Paradise, Oroville, and Chico. In the unincorporated areas of the county, including most of the areas adjacent to LOSRA, Butte County provides public services, including law enforcement and fire protection services. Table 3.4.18-2 summarizes public service expenditures during fiscal year 2000-01.

Table 3.4.18-2. Operating and capital expenditures (in thousands) by Butte County governments during fiscal year 2000-01.

Public Service	Butte County	Biggs	Chico	Gridley	Oroville	Paradise
General Government	$12,843	$507	$5,686	$491	$889	$1,613
Public Safety	$57,178	$395	$18,054	$2,067	$4,570	$6,336
Public Ways and Facilities	$13,447	$46	$6,699	$474	$1,216	$3,289
Planning and Zoning	$1,524	$62	$6,296	$584	$2,312	$86
Health, Sanitation, Education, and Welfare	$138,079	$2,198	$4,945	$2,414	$1,162	$230
Park, Recreation, and Cultural Services	$285	$28	$2,595	$179	$532	$1
Public Utilities and Other	$840	$756	$0	$2,171	$0	$0
Total	$224,196	$3,992	$44,275	$8,380	$10,681	$11,555

Note: Planning and zoning expenditures include code regulation enforcement, redevelopment, and community promotion expenditures.
Source: California State Controller's Office 2003.

3.4.19 Transportation and Traffic

The project area is generally located in a rural setting, approximately 3 hours by car from the San Francisco Bay Area and 1.5 hours from the City of Sacramento. Nearby urban areas include Chico and the City of Oroville. The project area is served by a roadway network of State highways and county and local roads. Figure 3.3-1 in Section 3.3 illustrates the primary regional roadways.

3.4.19.1 Transportation Access

Three major highways—SR 70, 99, and 162—provide transportation access to the Oroville Facilities. Two major interstate highways—Interstate 5 (I-5) and Interstate 80 (I-80)—connect to these State Routes.

SR 70 is a two-lane highway that runs parallel to SR 99 (north/south) between Sacramento and Oroville. Between Oroville and Quincy, SR 70 runs northeast/southwest. Between Quincy and Reno, SR 70 runs east/west to U.S. Highway 395 near the Nevada border.

SR 99 is a two-lane highway that runs primarily north/south, somewhat paralleling I-5 but providing inland access between the Sacramento area and Red Bluff. SR 99 connects Chico to Red Bluff to the north and Sacramento to the south.

SR 162 is a two-lane highway that runs east/west between I-5 and Oroville.

In addition to the regional roadways described above, the Oroville Airport is 3 miles southwest of the City of Oroville and is accessible from SR 162. The airport maintains two runways, and air traffic averages approximately 99 arrivals/departures per day (AirNav Website).

The Lake Oroville Landing Area Seaplane Base is 5 miles northeast of the City of Oroville with a 9,000-foot-diameter circular landing zone in the center of the reservoir. Seaplane operations at the Lake Oroville Landing Area Seaplane Base average approximately 25 arrivals/departures per year (AirNav Website).

Boat traffic on Lake Oroville is supported by marinas at Bidwell Canyon and Lime Saddle as well as by numerous boat ramps (see Section 3.4.17, Recreation).

3.4.19.2 Traffic Volumes

Table 3.4.19-1 lists ranges of average annual daily traffic (AADT) and level of service (LOS) for route segments in the region. LOS ratings provide an indication of how traffic is operating on roads or highways. Levels of service are generally given letter designations, with LOS A representing the best operating conditions, smooth traffic flow, and LOS F the worst with traffic at a standstill. Two-lane highways can be rated lower, because they present problems for passing if congestion is present. Congestion can be created by just a few slow-moving vehicles when passing becomes difficult or dangerous on a two-lane highway.

Table 3.4.19-1. AADT for State Routes in the project area.

State Route	2002 AADT Range Within the Project Area	LOS Range (Year) Within the Project Area
SR 70	1,600 to 57,000	A–E (2003)
SR 99	6,600 to 216,000	B–E (2000)
SR 162	980 to 28,500	A–E (2003)

Source: Caltrans 2003.

SR 70 ranges between 1,600 and 57,000 AADT. Between Sacramento and the City of Oroville, LOS on SR 70 is rated from A to E.

AADT on SR 99 ranges between 6,600 and 216,000. LOS is rated from B to E on SR 99 in the vicinity of Lake Oroville.

AADT on SR 162 ranges between 980 and 28,500. LOS is rated from A to E on segments 2–6 of SR 162, which are located in the vicinity of Lake Oroville.

Traffic on the road and highway network in and near the Oroville Facilities is normally free flowing with little congestion. Roads and highways are in generally good to adequate condition. The California Department of Transportation (Caltrans) maintains State Routes and interstate highways in the project area. Butte County (County) maintains the majority of local roads in the area immediately surrounding LOSRA. DPR maintains roads within LOSRA. DWR maintains the roads within the FERC boundary that are not encompassed within LOSRA.

Of the State Routes in the project area, approximately half of them have LOS ratings of C or better. The main road segments approaching Lake Oroville have impaired drivability. Caltrans plans to improve State Routes with regular congestion as budget allocations allow (pers. comm., Van Valen 2003). The Interregional Transportation Strategic Plan identifies the portion of SR 70 between its junction with SR 99 in Sutter County and SR 149 in Butte County as a “High-Emphasis Focus Route,” which means it is one of Caltrans’ highest priority routes for project planning and programming. The intent is to improve this portion of SR 70 to full freeway standard (Caltrans 2003).

The majority of heavy traffic is associated with recreational uses, including Bidwell Canyon, Lime Saddle, North Thermalito Forebay, Loafer Creek, the Lake Oroville Visitors Center, Oroville Dam, and Spillway BR/DUA. High use affects roads over time, and these areas require more road maintenance than less traveled roads. Many of the recreational visitors’ cars and trucks tow boat trailers, which can affect traffic conditions. Most of the roads that lead to the high-use sites pass through residential neighborhoods and commercial areas.

3.4.20 Water Quality

This section describes the current understanding of important seasonal and long-term water quality conditions in the Feather River watershed. Water quality is an important factor for project facilities and operations, starting from the upper watershed and inflows to Lake Oroville, within Lake Oroville, through the powerhouses and fish hatchery to the Thermalito complex of storage facilities, and beyond to the lower Feather River, the Sacramento River, and the San Francisco Bay/Delta area. The physical, chemical, and biological properties of water can have direct and dramatic effects on the vitality of aquatic organisms, water-dependent aquatic habitat, human health, recreation, agriculture, and other beneficial uses of the water. In turn, aquatic biological growth conditions may result in excessive bacteria, algae, and other biotic responses that can be considered water quality variables of concern. Many water quality variables are highly interrelated (e.g., temperature affects dissolved oxygen [DO] conditions). The relationships are typically complex, and there is a level of uncertainty in any given aquatic system regarding how factors interrelate. Controllable factors such as land management actions and reservoir operations greatly affect water quality, but these relationships are often poorly understood. These uncertainties complicate the management of water quality and have resulted in a complex regime of federal and State regulations to protect beneficial uses.

3.4.20.1 Upper Feather River Watershed

Water quality data collected in the North, Middle, and South Forks of the Feather River indicate that commonly measured physical (e.g., temperature, turbidity) and chemical (e.g., DO, pH, conductivity) variables have generally been within the established water quality goals and criteria of regulatory agencies. As in most watersheds, winter storms cause spikes in turbidity as soil and organic litter are transported in runoff from steep, mountainous slopes. Plant nutrients (nitrogen and phosphorus) have generally been less than the levels considered stimulatory to algal production. A few trace metals occasionally have exceeded criteria for beneficial uses including mercury, arsenic, cadmium, lead, and iron. Mercury is an important contaminant of concern because of its toxicity to organisms and the fact that large quantities may still reside in the watershed, a remnant of the gold mining era when it was used for ore processing. Hard-rock mining also produced large quantities of pulverized tailings. Many of these tailings now release acidic runoff and toxic trace metals into some of the streams above Lake Oroville. Historical uses of hazardous substances in the upper watershed may also have resulted in deposition of organic compounds such as polychlorinated biphenyls (PCBs) and some pesticides that are resistant to decay and remain toxic for long periods in the aquatic environment. Existing beneficial uses in the upper tributaries designated by the Central Valley Regional Water Quality Control Board (RWQCB) vary depending on location but generally include municipal supply, contact and noncontact recreation, canoeing and rafting, hydropower, cold and warm freshwater habitat for resident species, cold freshwater spawning habitat, and wildlife habitat.

3.4.20.2 Lake Oroville

Lake Oroville is a deep reservoir that thermally stratifies in the summer and mixes during most of the rest of the year. Water temperatures during the winter are generally uniform at about 45°F. Stratification typically occurs from April through September, with surface temperatures warming to a maximum of about 75°F in August. Water temperature below the thermocline is about 50°F during the summer. The reservoir has excellent physical water quality conditions, with DO remaining high throughout the water column for the entire year. Nutrient levels and growth of nuisance algae in the reservoir are generally low. Concentrations of other physical and chemical parameters (e.g., turbidity, pH, minerals) and trace constituents (i.e., metals and organic compounds) are generally satisfactory and comply with Water Quality Control Plan

(Basin Plan) objectives. Existing beneficial uses in Lake Oroville include municipal supply, contact and noncontact recreation, irrigation and hydropower supply, coldwater and warmwater resident fish habitat, coldwater and warm freshwater spawning habitat, and wildlife habitat.

Sediments that deposit within Lake Oroville potentially contain elevated levels of trace metals and organic compounds that may bioaccumulate in the food web. Bioaccumulation is the process whereby a contaminant is concentrated as it is transported to higher trophic levels within the food chain. The contaminant may reach concentrations that are deleterious to organisms and humans that ingest them. Sediments initially deposit in the upper tributary arms of Lake Oroville and can be transported farther into the reservoir by high streamflows, reduced reservoir water levels, or periodic discharge surges from upstream hydropower generation. Potentially occurring anoxic (i.e., oxygen deficient) conditions at and beneath the sediment-water interface can be conducive to formation of methyl mercury, which may be distributed into the water column during mixing in the reservoir. Limited sampling for metals in the tissues of some fish from Lake Oroville and the lower Feather River has detected mercury at concentrations that exceed current regulatory criteria.

3.4.20.3 Lower Feather River, Thermalito Forebay, and Thermalito Afterbay

The large coldwater pool available within Lake Oroville results in relatively constant maximum water temperatures in the lower Feather River of about 63°F. Nutrient and mineral concentrations in the lower Feather River are low. Existing beneficial uses in the lower Feather River include municipal supply, contact and noncontact recreation, canoeing and rafting, irrigation supply, coldwater and warmwater habitat, cold and warm freshwater spawning habitat, and wildlife habitat.

Water temperatures in Thermalito Forebay and Thermalito Afterbay generally reflect the patterns of release flows from Lake Oroville. Conditions in Thermalito Afterbay are fairly uniform, with mean daily water temperatures during the summer in the upper 60s, and rarely over 70°F. Thermalito Afterbay temperature conditions are an important issue for local rice growers as water temperature needs to exceed about 65°F from April through mid-May for optimum seed germination. Water temperatures in the lower Feather River vary in response to climatic factors, overall long-term water supply conditions and runoff patterns, pump-back operations, and flow control with the temperature control device.

Physical and chemical parameters in the lower Feather River and diversion and storage features (Thermalito Diversion Pool, Thermalito Forebay, Thermalito Afterbay, and OWA ponds) are generally within the range of applicable water quality objectives and also reflect conditions of Lake Oroville. Water quality conditions can vary in response to flow fluctuations, water temperature changes, sedimentation, contaminant transport, and physical or chemical transformations that occur in the river. Boron and adjusted sodium adsorption ratios are low, indicating that waters are well suited for agricultural uses. Periodic discharges of ammonia, nitrate, fecal coliform bacteria, and other water quality constituents can occur in seepage from the wastewater holding pond at the Feather River Fish Hatchery. Biotic integrity as measured by benthic macroinvertebrate community indices indicates that diversity is low. Elevated levels of arsenic, cadmium, and copper have occasionally been found in samples collected from the river and analyzed for water quality. Total mercury concentrations have exceeded applicable human health criteria. Table Mountain contains historic mines that may contribute contaminated runoff to Thermalito Forebay.

3.4.20.4 Groundwater in the Lower Feather River Area

Oroville Dam and Lake Oroville are underlain by relatively impermeable igneous and metamorphic bedrock that largely eliminates interaction of groundwater with Lake Oroville. However, Thermalito Forebay and Thermalito Afterbay are located on more permeable volcaniclastic and consolidated alluvial sediments where reservoir water and local groundwater do interact. Groundwater flows in a south-southwest direction in the vicinity of Thermalito Forebay and Thermalito Afterbay. Groundwater quality locally reflects the characteristics of the upper unconfined groundwater aquifers surrounding these features. Although unquantified at this time, the local groundwater quality conditions may vary in response to interaction between these features and would depend on the seasonal background conditions, rate of seepage, quality of seepage, and mixing of groundwaters within the aquifers. Unless otherwise designated by the RWQCB, all groundwaters in the region are considered suitable or potentially suitable, at a minimum, for municipal, agricultural, industrial service, and industrial process supplies. Groundwater studies are currently under way to evaluate the localized effects on groundwater levels and groundwater quality caused by the interaction with Thermalito Forebay and Thermalito Afterbay.

3.4.20.5 Recreation and Water Quality

Recreational activities within the upper and lower Feather River watershed and reservoirs include boating, fishing, camping, picnicking, swimming, horseback riding, hiking, bicycling, wildlife viewing, and hunting. Recreational activities can affect water quality as a result of direct discharges of contaminants from motorized traffic (e.g., oil and grease, other petroleum byproducts, fuel oxygenates) and human/animal wastes (e.g., bacterial pathogens, trash). Despite being phased out of use in California, methyl tertiary butyl ether (MTBE) has been detected in Lake Oroville, with concentrations decreasing rapidly at the end of the boating season. Water quality may vary in response to trampling of soil and vegetation, erosion (from boat wakes) and associated resuspension of nutrients, and potential presence of contaminants in the sediments. Wildlife and waterfowl populations may affect levels of animal waste products and pathogens in the water.

3.4.21 Wildlife Resources

Variability in slope, aspect, precipitation, elevation, hydrology, land use, and edaphic factors results in a diversity of wildlife habitats within and adjacent to the project area. These diverse habitat assemblages can support a variety of wildlife species, including numerous recreational/commercial species as well as special-status (sensitive) species. Wildlife habitats within the project area are managed by several land management agencies including the USFS, BLM, DPR, DFG, and DWR.

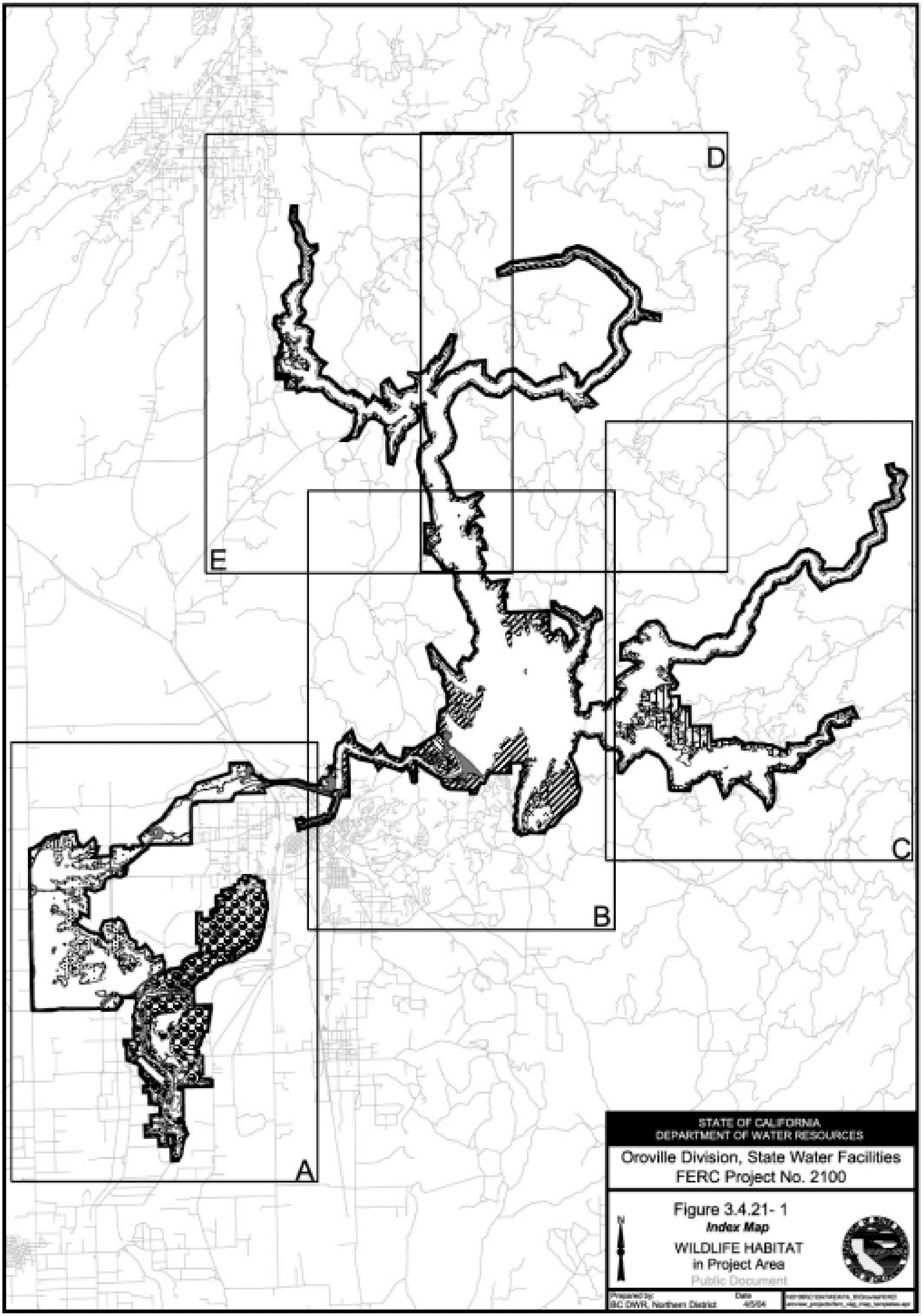
3.4.21.1 Wildlife Habitats

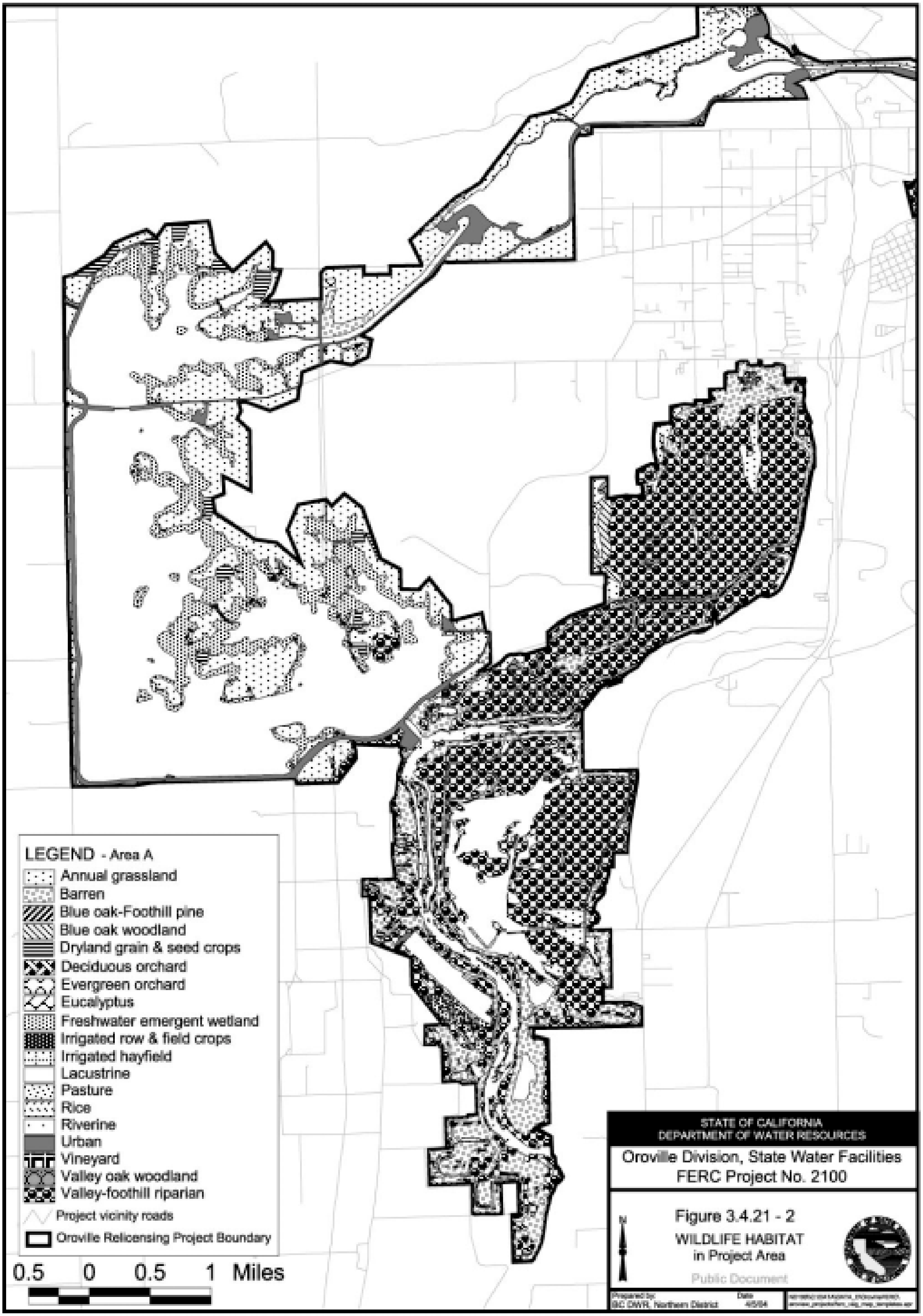
The principal wildlife habitat types in the project area include lacustrine, montane hardwood, blue oak/foothill pine, valley/foothill riparian, montane hardwood conifer, annual grassland, barren, fresh water emergent wetland, urban, blue oak woodland, and riverine (Table 3.4.21-1 and Figures 3.4.21-1 through 3.4.21-6). In general, the wildlife habitat types within the Oroville Facilities project area are dominated by lacustrine and montane hardwood.

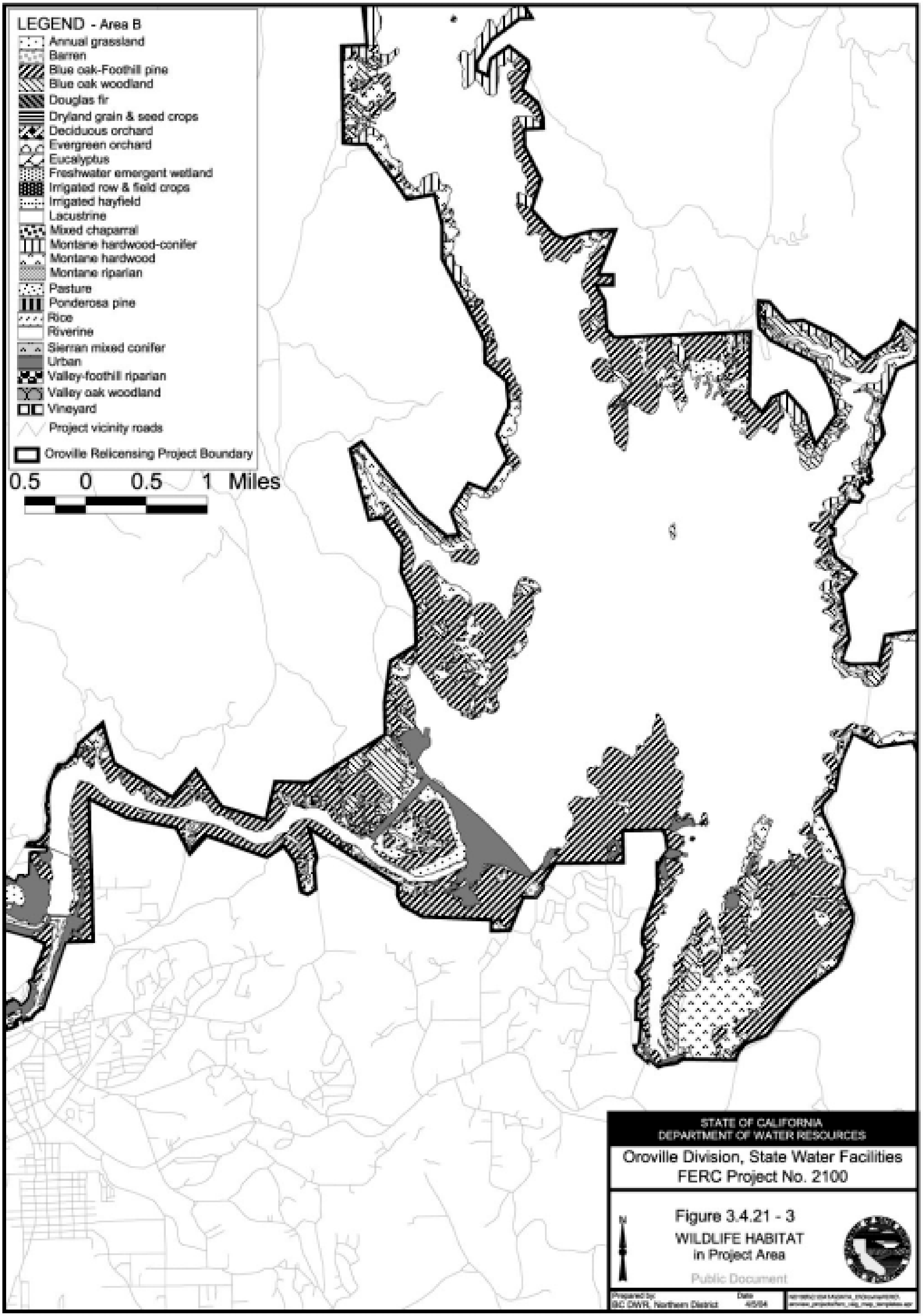
Table 3.4.21-1. Summary of wildlife habitat acreages within the project area.

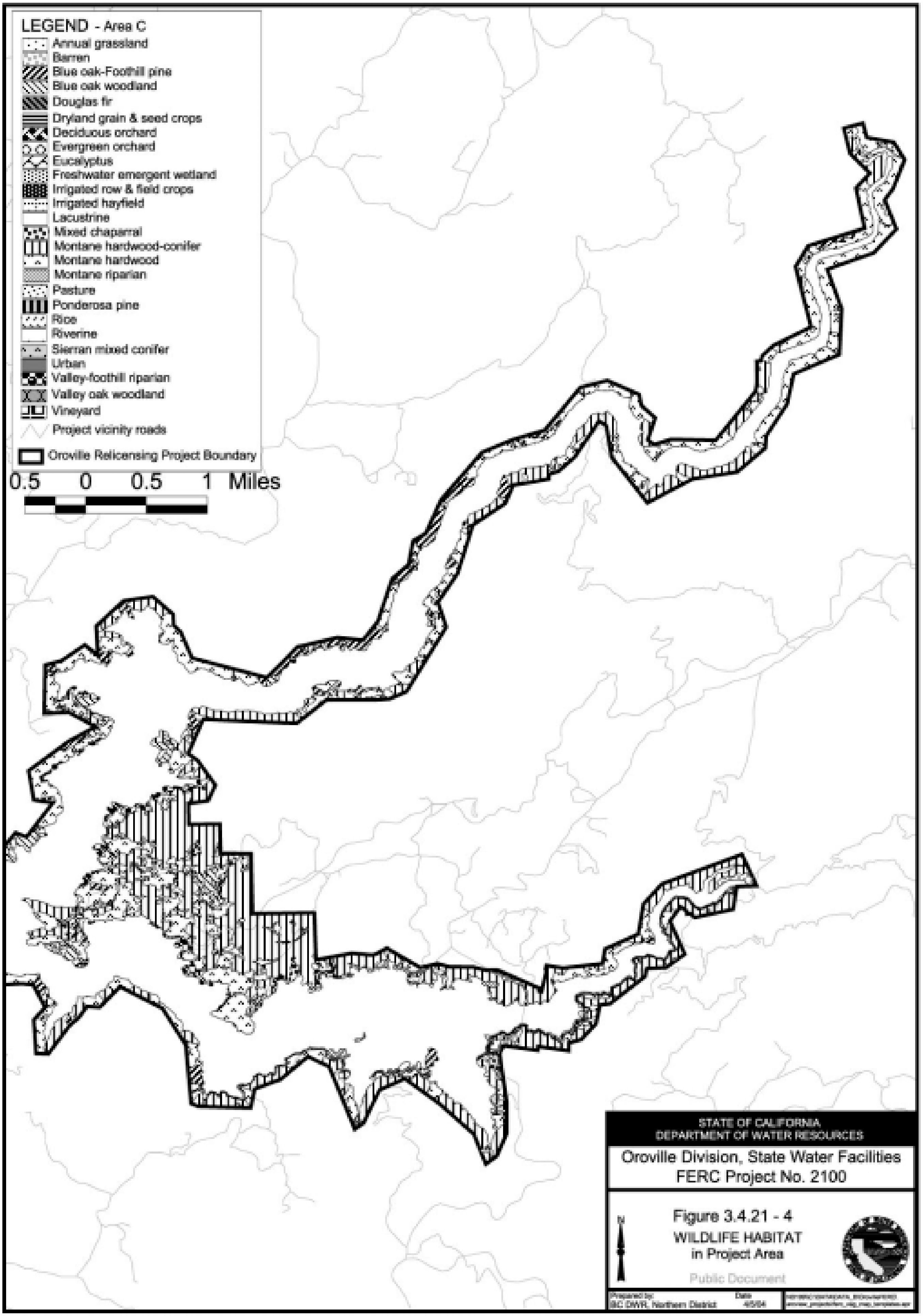
CWHR Habitat Type	Total Acres Within Project Area	Number of Polygons	Number of Seral Stages
Lacustrine	19,851.9	346	6
Montane Hardwood	3,295.0	733	11
Blue Oak/Foothill Pine	3,518.8	498	12
Valley Foothill Riparian	3,398.1	558	13
Montane Hardwood/Conifer	3,179.8	597	8
Annual Grassland	2,751.5	283	6
Barren	1,394.4	143	1
Freshwater Emergent Wetland	911.6	225	3
Urban	868.2	132	1
Blue Oak Woodland	793.3	210	10
Riverine	452.9	83	5
Mixed Chaparral	234.3	156	8
Douglas-fir	169.6	8	1
Sierra Mixed Conifer	112.5	31	2
Dryland Grain	98.3	12	1
Montane Riparian	54.3	97	4
Deciduous Orchard	11.0	20	3
Valley Oak Woodland	9.8	3	3
Evergreen Orchard	8.1	7	2
Irrigated Hayfield	3.3	1	1
Ponderosa Pine	3.2	1	1
Eucalyptus	2.6	4	3
Pasture	0.7	6	1
Vineyard	0.2	1	1

Source: Mayer and Laudenslayer 1988
CWHR = California Wildlife Habitat Relationships database


D
E
C
B
A
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.21- 1
Index Map
WILDLIFE HABITAT
in Project Area
Public Document
Prepared by:
BC DWR, Northern District


LEGEND - Area A
Annual grassland
Barren
Blue oak-Foothill pine
Blue oak woodland
Dryland grain & seed crops
Deciduous orchard
Evergreen orchard
Eucalyptus
Freshwater emergent wetland
Irrigated row & field crops
Irrigated hayfield
Lacustrine
Pasture
Rice
Riverine
Urban
Vineyard
Valley oak woodland
Valley-foothill riparian
Project vicinity roads
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.21 - 2
WILDLIFE HABITAT
in Project Area
Public Document
N


LEGEND - Area B
Annual grassland
Barren
Blue oak-Foothill pine
Blue oak woodland
Douglas fir
Dryland grain & seed crops
Deciduous orchard
Evergreen orchard
Eucalyptus
Freshwater emergent wetland
Irrigated row & field crops
Irrigated hayfield
Lacustrine
Mixed chaparral
Montane hardwood-conifer
Montane hardwood
Montane riparian
Pasture
Ponderosa pine
Rice
Riverine
Sierran mixed conifer
Urban
Valley-foothill riparian
Valley oak woodland
Vineyard
Project vicinity roads
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.21 - 3
WILDLIFE HABITAT
in Project Area
Public Document
N
Prepared by:
BC DWR, Northern District
Date
4/5/04



LEGEND - Area C
Annual grassland
Barren
Blue oak-Foothill pine
Blue oak woodland
Douglas fir
Dryland grain & seed crops
Deciduous orchard
Evergreen orchard
Eucalyptus
Freshwater emergent wetland
Irrigated row & field crops
Irrigated hayfield
Lacustrine
Mixed chaparral
Montane hardwood-conifer
Montane hardwood
Montane riparian
Pasture
Ponderosa pine
Rice
Riverine
Sierran mixed conifer
Urban
Valley-foothill riparian
Valley oak woodland
Vineyard
Project vicinity roads
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.21 - 4
WILDLIFE HABITAT
in Project Area
Public Document
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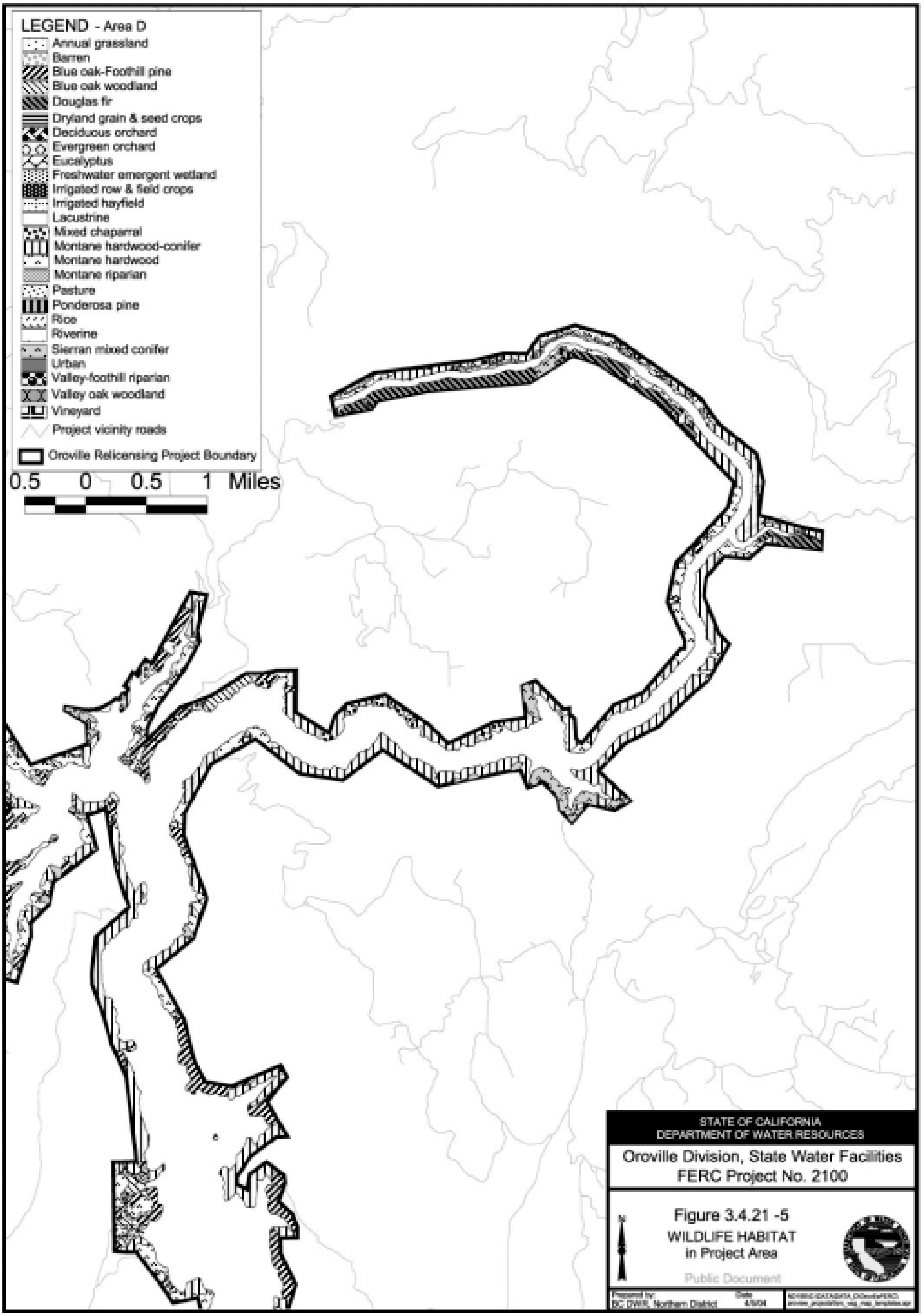
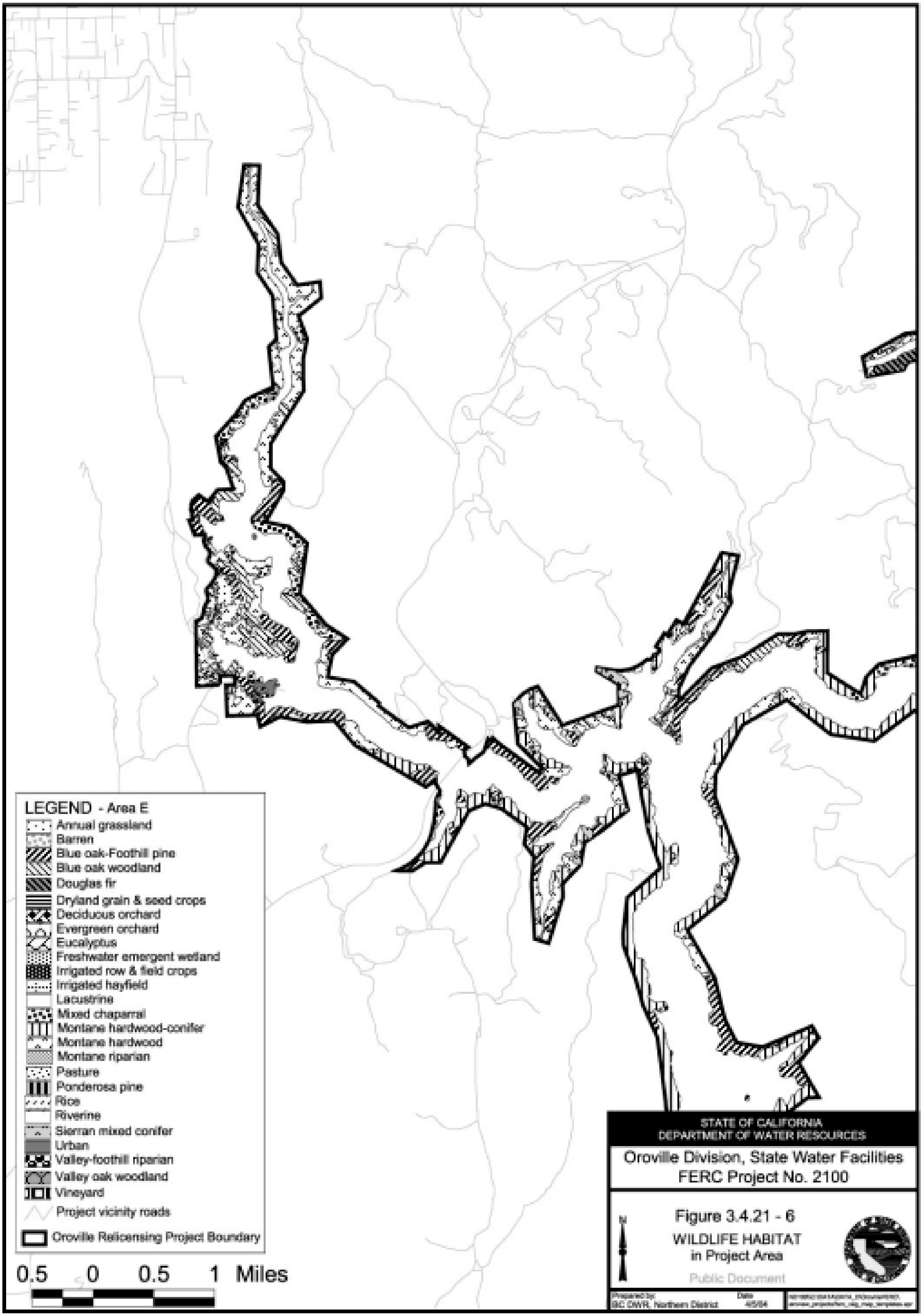
Prepared by:
BC DWR, Northern District
Date
4/5/04


LEGEND - Area D
Annual grassland
Barren
Blue oak-Foothill pine
Blue oak woodland
Douglas fir
Dryland grain & seed crops
Deciduous orchard
Evergreen orchard
Eucalyptus
Freshwater emergent wetland
Irrigated row & field crops
Irrigated hayfield
Lacustrine
Mixed chaparral
Montane hardwood-conifer
Montane hardwood
Montane riparian
Pasture
Ponderosa pine
Rice
Riverine
Sierran mixed conifer
Urban
Valley-foothill riparian
Valley oak woodland
Vineyard
Project vicinity roads
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.21 -5
WILDLIFE HABITAT
in Project Area
Public Document
N


LEGEND - Area E
Annual grassland
Barren
Blue oak-Foothill pine
Blue oak woodland
Douglas fir
Dryland grain & seed crops
Deciduous orchard
Evergreen orchard
Eucalyptus
Freshwater emergent wetland
Irrigated row & field crops
Irrigated hayfield
Lacustrine
Mixed chaparral
Montane hardwood-conifer
Montane hardwood
Montane riparian
Pasture
Ponderosa pine
Rice
Riverine
Sierran mixed conifer
Urban
Valley-foothill riparian
Valley oak woodland
Vineyard
Project vicinity roads
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure 3.4.21 - 6
WILDLIFE HABITAT
in Project Area
Public Document
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Prepared by:
BC DWR, Northern District
Date
4/5/04

Lacustrine habitat includes lakes, reservoirs, and ponds greater than 5 acres in size containing standing water (Mayer and Laudenslayer 1988). Lacustrine habitat is subdivided into limnetic zone (deep open water), littoral zone (shallow water areas where light penetration occurs to the bottom), and shore (water border with less than 2 percent vegetative cover). Lacustrine habitat provides all of the life history requirements (reproduction, food, water, and cover) for 150 wildlife species in California (Mayer and Laudenslayer 1988). Waterfowl use open-water areas for resting and feeding. Osprey, cormorants, bald eagle, mergansers, and gulls forage in open-water habitats. Grebes, herons, and diving ducks forage in the littoral zone. Swallows, bats, and swifts forage over lacustrine habitat. Banks associated with lacustrine habitat can provide cover or reproductive habitat for western pond turtle, river otter, and beaver. Lacustrine habitat is present in the project area at Lake Oroville, the Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay, as well as in ponded habitat along the Feather River.

Montane hardwood habitat is dominated by a pronounced hardwood layer with an infrequent and poorly developed shrub understory. Tree densities are generally dense while canopy closures are generally greater than 60 percent. This habitat occurs on steep and rocky substrates. Common species include Steller’s jay, mountain quail, band-tailed pigeon, black bear, ensatina, rubber boa, and mountain kingsnake.

Blue oak/foothill pine habitat exhibits high structural and plant species diversity because of the presence of multilayered tree canopies, shrub understory, and herbaceous ground cover. Blue oaks grow slowly and regeneration is rarely observed in grazed stands. Approximately 130 wildlife species are known to use this habitat type for reproduction in the western Sierra Nevada (Mayer and Laudenslayer 1988). Common wildlife species include western fence lizard, western rattlesnake, acorn woodpecker, oak titmouse, western bluebird, black-tailed deer, Cooper’s hawk, wild turkey, and lark sparrow.

Mature valley/foothill riparian habitat is structurally composed of a dominant deciduous overstory (California sycamore, valley oak, and cottonwood); an understory tree layer (white alder, Oregon ash); and a shrub layer (willows, poison oak, elderberries). Canopy closures range from 20 to 80 percent and understories are frequently dense. Herbaceous ground cover is generally lacking or limited to woodland openings. Riparian habitat provides food, water, cover, and reproduction areas for a wide variety of California wildlife species including 50 reptiles and amphibians, 55 mammals, and 147 birds (Mayer and Laudenslayer 1988). Riparian habitat also provides migration and dispersal corridors and thermal cover for many species. Numerous wildlife species are largely dependent upon valley/foothill riparian habitat including red-shouldered hawk, western yellow-billed cuckoo, yellow-breasted chat, and mink. Extensive stands of mature valley/foothill riparian habitat occur within the project area along the Feather River downstream of the community of Oroville. Narrow strips of riparian habitat also occur in association with the tributaries to Lake Oroville.

Within mature montane conifer/hardwood habitat, at least 30 percent of the tree layer is composed of conifers and at least 30 percent is deciduous or evergreen hardwoods. The combination of conifers and hardwoods results in a multilayered forest structure. Early seral stages contain a variety of shrub species, while mature stands often exhibit high canopy closure rates and little understory vegetation. Representative wildlife species include California newt, Nashville warbler, yellow-rumped warbler, mountain quail, black-headed grosbeak, and black bear. Discontinuous patches of montane hardwood/conifer habitat are present within the project area. This habitat is most common on north-facing slopes on the upper arms of Lake Oroville. This habitat becomes increasingly common at higher elevations upslope from the project area.

Annual grassland habitat is primarily composed of annual grasses and forbs and occurs in areas receiving less than 40 inches of precipitation per year. Moist areas within annual grasslands can support perennial species like purple needlegrass and Idaho fescue. Vernal pools can occur in annual grassland habitat where depressions are underlain by impervious clay or hardpan soils. Annual grassland composition and structure is highly dependent upon precipitation and historic grazing practices. Common wildlife species include black-tailed jackrabbit, California ground squirrel, gopher snake, western fence lizard, California vole, badger, western kingbird, burrowing owl, horned lark, western meadowlark, Brewer’s blackbird, American kestrel, turkey vulture, and northern harrier. Annual grassland habitat occurs around Thermalito Forebay, Thermalito Afterbay, the Thermalito Power Canal, upland locations along the Feather River, and in isolated patches within the blue oak/foothill pine habitat around Lake Oroville.

Barren habitats are defined as areas with less than 2 percent herbaceous cover and less than 10 percent tree cover. Within the project area, barren areas primarily include dredger tailings, unvegetated gravel bars, and rock outcrops. Barren habitats support relatively few wildlife species. Species commonly associated with barren habitats include western rattlesnake, California gull, common raven, and killdeer.

Emergent wetland habitats are dominated by short, erect, rooted hydrophytes (cattail, tule bulrush) and occur in waters less than 6 feet in depth. Stands tend to be dense and structurally simple. Seasonal flooding restricts species diversity to those species adapted to anaerobic soil conditions. Emergent wetlands are a successional community developing from open water through time to upland habitat. Erosion rates control the rate of successional change. Freshwater emergent wetlands can provide habitat for more than 160 species of birds in California as well as key habitat for numerous species of reptiles, amphibians, and mammals (Mayer and Laudenslayer 1988). Characteristic species include red-winged blackbird, giant garter snake, mallard, muskrat, short-eared owl, and bullfrog. Strips of emergent wetland habitat are found around Thermalito Afterbay, Thermalito Forebay, within dredger ponds in the OWA, and in backwater areas along the Feather River. Emergent wetlands are generally absent within the drawdown zone of Lake Oroville or within the steeper drainages upslope from the reservoir.

Urban/disturbed habitat is structurally divided into five classes including tree grove, street strip, shade tree/lawn, lawn, and shrub cover (Mayer and Laudenslayer 1988). Urban habitats frequently exhibit high structural diversity, high plant species diversity, and extensive edge areas. Both native and non-native plant species occur. However, non-native annual and perennial species are frequently dominant. Maintenance normally precludes community succession in urban/residential habitat. Common wildlife species associated with urban/residential habitat include European starling, house sparrow, rock dove, northern mockingbird, house finch, gopher snake, western fence lizard, striped skunk, and opossum. Areas mapped as urban habitat within the project area include structures and recreational facilities.

Blue oak woodland habitat is comprised of a hardwood overstory largely composed of blue oak (85–100 percent of trees present) and exhibits highly variable canopy closures. Blue oak woodland frequently exists as a scattering of mature trees. Shrub understories are uncommon and annual grassland species dominate the herbaceous layer. Common wildlife species associated with this habitat type include western fence lizard, western rattlesnake, acorn woodpecker, oak titmouse, western bluebird, black-tailed deer, Cooper's hawk, and lark sparrow.

Riverine habitat (streams and rivers) structure consists of open water (greater than 2 feet in depth), submerged near shore areas, and banks with less than 10 percent canopy cover (Mayer and Laudenslayer 1988). Waterfowl use open-water areas for resting. Osprey, cormorants, and gulls forage in open-water habitats. Shorebirds, including herons, egrets, and sandpipers, forage along the submerged nearshore areas. Insectivorous species, including swallows and phoebes, forage over riverine habitat. Banks associated with riverine habitat can provide cover or nesting substrate for bank swallow, belted kingfisher, muskrat, and beaver. Riverine habitat occurs throughout the project area along the Feather River and its tributaries.

3.4.21.2 Commercially and Recreationally Important Species

The project area provides seasonal or year-round habitat for a variety of commercially or recreationally important wildlife species. About 55 species classified as harvest species by DFG may occur within the project area. Black-tailed deer are an important big-game species in eastern Butte County. The project area contains a portion of the winter range of two migratory deer herds (Bucks Mountain and Mooretown herds) as well as a small resident population.

Waterfowl remain the most important (both commercial and recreational) group of wildlife in the lower elevation portions of Butte County. Lands managed for commercial grain production or natural wetlands support high wintering densities of ducks, geese, swans, and shorebirds. These lands also provide waterfowl nesting and brooding habitat. Waterfowl hunting access fees provide landowners with financial incentives to manage for waterfowl. Portions of OWA within the FERC boundary are managed by DFG to provide habitat for nesting and wintering waterfowl. Approximately, 2 percent of the recreational use of this Wildlife Area is related to waterfowl hunting. The Thermalito Afterbay/Forebay complex provides resting and foraging habitat for open- water and diving waterfowl species (ruddy duck, bufflehead, scaup, ring-necked duck, common goldeneye, and common merganser), which is generally lacking in surrounding agricultural areas.

Upland game species including mourning dove, wild turkey, ring-necked pheasant, and several species of quail are found within the project area and provide hunting opportunities on adjacent private lands as well as on some public lands including OWA.

Numerous furbearers including badger, mink, beaver, raccoon, gray fox, weasels, muskrat, bobcat, and opossum may occur in the project area. However, current commercial harvest of these species within the project area is believed to be negligible. Use of steel leg-hold traps is currently prohibited in California.

Non-consumptive uses (birdwatching or nature study) is estimated to be greater than all wildlife-related consumptive use combined within the project area on an annual basis. Students from local colleges, high schools, and elementary schools make use of the project area for nature/biological education and study.

3.4.21.3 Special-Status Species

Relicensing studies indicate the presence of, or suitable habitat for, 12 species protected under the California or federal Endangered Species Acts within the immediate project area. These species include bald eagle, peregrine falcon, greater sandhill crane, bank swallow, Swainson's hawk, western yellow-billed cuckoo, California red-legged frog, giant garter snake, valley elderberry longhorn beetle, vernal pool tadpole shrimp, Conservancy fairy shrimp, and vernal pool fairy shrimp.

In addition to formally listed species, 17 BLM or USFS sensitive species may also occur in the project area. Further, an additional 24 species classified as State or federal Species of Concern have been documented within the FERC boundary.

3.4.21.4 Existing Wildlife Management of Lands within the FERC Boundary

The 11,000-acre OWA, west of the City of Oroville, is managed by DWR and DFG for wildlife habitat and recreational activities. Habitats within OWA include lacustrine, riverine, freshwater emergent, valley foothill riparian, and annual grassland and dryland grain/seed crops. This area includes Thermalito Afterbay and the 6,000 acres surrounding it and the 5,000 acres adjacent to and straddling 12 miles of the Feather River. Wildlife habitat enhancement programs include wetland habitat enhancements, a wood duck nest box program, and dryland farming for nesting cover and improved wildlife forage. Habitat quality in this area is adversely affected by historic dredger tailings within the Feather River floodplain.

3.5 APPROACH USED TO DEVELOP THE PROPOSED ACTION AND ITS PRIMARY ALTERNATIVES

This section describes the approach used to develop the primary alternatives for the FERC relicensing. The steps involved in this approach are as follows:

- Summarize scoping issues;
- Develop and conduct technical studies;
- Define proposed resource actions/PM&E measures; and
- Evaluate proposed resource actions/PM&E measures.

These steps are described below. Following the discussion of these development steps, this section includes a discussion of the overall approach to constructing the Proposed Action and its primary alternatives.

3.5.1 Summarize Scoping Issues

Since June 2000, DWR has participated with stakeholders in an open process to identify potential issues, concerns, and goals related to relicensing of the Oroville Facilities. This process included public distribution of Draft Scoping Document 1 in 2001, which was designed to further public understanding of the Oroville Facilities and to solicit comments on the scope of the PDEA and any supplemental information to be filed with FERC as part of DWR's Application for New License and submitted to the State Clearinghouse as required by the California Environmental Quality Act (CEQA). In addition to the collaborative meetings, which are open to the public, public scoping meetings were held on October 29 and 30, 2001. Any person who was unable to attend a public scoping meeting had the opportunity to submit written comments and information to DWR.

The Final NEPA Scoping Document 1 and CEQA Notice of Preparation (SD1) was issued in September 2002. Appendix B of SD1, “Resource Issues, Concerns and Comments Tracking,” consists of comments and recommendations received by the licensee in response to Draft Scoping Document 1 and from public scoping meetings and written responses, and provides a record of issues related to this effort.

3.5.2 Develop and Conduct Technical Studies

The resource issues, concerns, and comments contained within SD1 Appendix B and the issue statements developed by the Collaborative were used by representatives from federal, State, and local governments and resource agencies, Indian Tribes, nongovernmental organizations, and local special-interest groups and local residents to cooperatively develop 71 study plans that would provide supporting data and analysis for the PDEA. The results of these studies will address issues identified during the formal scoping process and public meetings, and will fulfill regulatory requirements associated with relicensing. In some cases, the study plans may also address issues outside FERC's authority that may be included in a settlement agreement. The studies address issues related to five broad resource areas: (1) environmental (i.e., water quality, fisheries, terrestrial, botanical); (2) engineering and operations; (3) land use, land management, and aesthetics; (4) recreation and socioeconomics; and (5) cultural resources.

Abstracts of the Technical Study Plan reports are provided in Appendix E.

3.5.3 Define Proposed Resource Actions/PM&E Measures

The development of PM&E measures is required to comply with the ALP. As described in the history below, potential PM&E measures were and are called Resource Actions (RAs) by stakeholders and Work Groups. Over time, the legal term "PM&E" was also adopted by several Work Groups and stakeholders. For the License Application, specific PM&E measures will need to be defined and evaluated to further the process. Some of these measures will be carried forward for further analysis as part of the primary action alternatives.

3.5.3.1 History of RA/PM&E Measure Development

Throughout 2002, the Work Groups and associated task forces worked cooperatively to review and refine myriad issues. This refinement included the identification of issues and questions, clarification of related resource goals, identification of existing/needed information to answer questions, agreement on the appropriate level of analysis required, regulatory standards, and other related issues. The five collaborative Work Groups (Cultural; Environmental; Recreation and Socioeconomics; Engineering and Operations; and Land Use, Land Management, and Aesthetics) initiated discussion of potential RAs by first reviewing the Issue Tracker (SD1), which includes issues, concerns, and potential actions documented since the Collaborative process began. Potential RAs included in the Issue Tracker were matched to the appropriate Work Group and formed the basis for individual Work Group RA tracking matrices.

In 2003, the Plenary Group established a Process Task Force to develop a Resource Action Identification Form (RAIF) to support the Collaborative by providing a common template by which individual stakeholders would describe a proposed RA and provide basic information considered necessary to begin analysis of potential resource actions related to the relicensing process. The RAIF was designed to allow relicensing participants and Work Groups to propose RAs associated with specific issues. Participants were invited to identify the specific issue a potential RA is designed to address and provide basic information considered necessary to begin analysis, including a description of the Proposed Action, any alternatives to the Proposed Action, methods for measuring performance and success, and information where possible to support analysis of the action.

Stakeholders participating in the individual Work Groups were encouraged to submit new RAs or clarify existing ones by completing a RAIF. RAIFs were submitted to individual Work Groups or directly to DWR for distribution to the appropriate Work Group. Additional RAIFs were developed and refined by participants within the Work Groups themselves. In some cases, RAIFs were transferred between Work Groups as participants considered the most appropriate venue for discussion and further refinement.

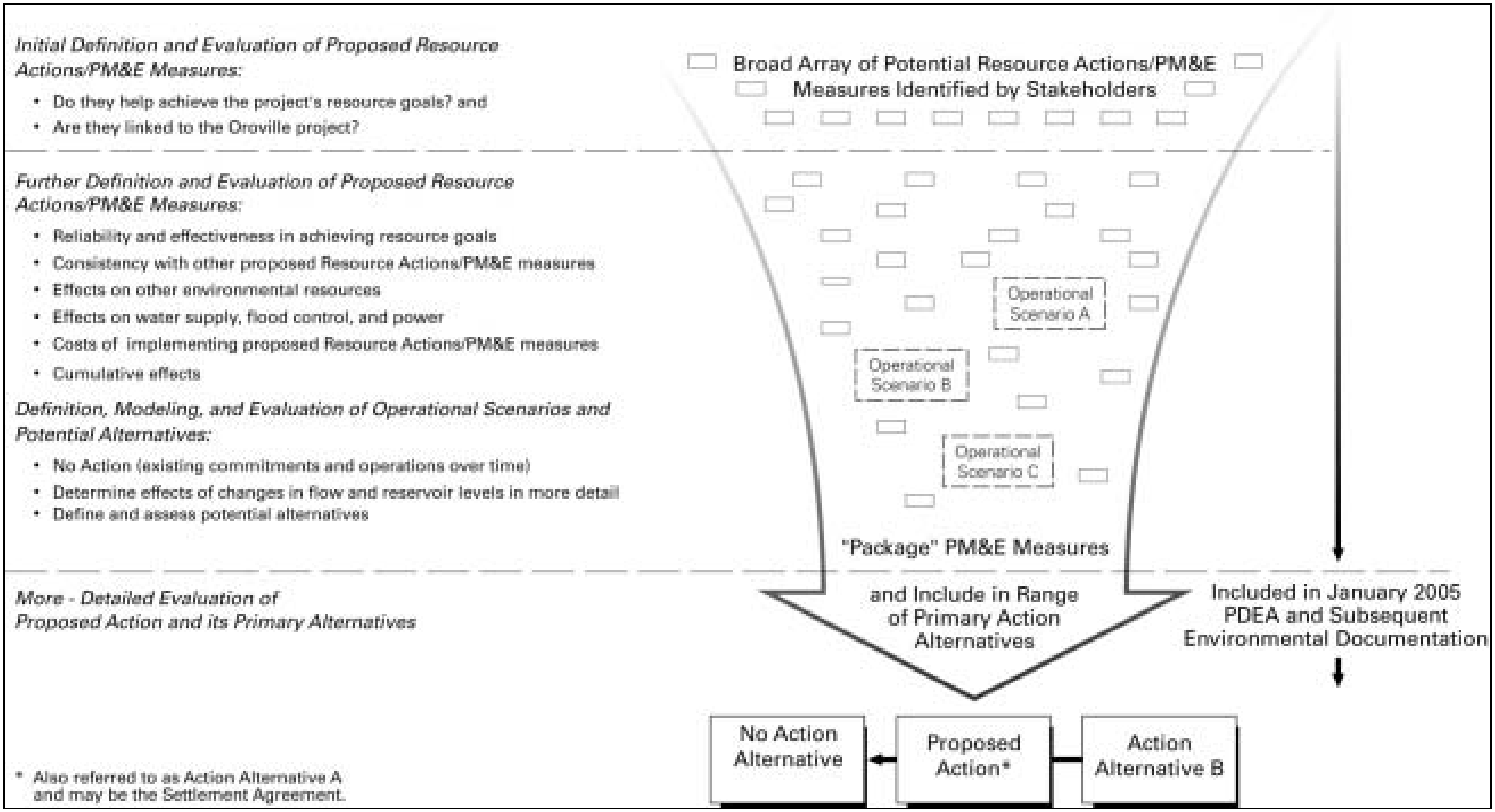
The Work Groups spent many months developing RAs, identifying and eliminating redundancies, and consolidating similar or synergistic RAs as appropriate. During this time, several Work Groups initiated focused task forces to develop and evaluate technical information useful in assisting the larger Work Group with RA discussion and prioritization. Initial results from the numerous studies under way were used to inform the Work Groups related to project effects and further refine potential RAs. Each Work Group then identified those RAs that could reasonably be expected to produce beneficial results and agreed by consensus to recommend the list of RAs for further analysis as PM&E measures. The RAs/PM&E measures were forwarded to the Plenary Group and the PDEA team for further evaluation. Each Work Group maintained a master list of all potential RAs/PM&E measures considered during the process for tracking purposes. This master list of all RAs/PM&E measures that were received by DWR from the Work Groups, the stakeholders, and the USFS is attached in Appendix F.

3.5.4 Evaluate Proposed Resource Actions/PM&E Measures

DWR and its consultants are evaluating the RAs/PM&E measures. This evaluation is an important part of the alternatives development process (see Figure 3.5-1). As part of this process, a PM&E measure definition and evaluation form was developed that incorporates key information from the RAIFs described above. This form is being used to ensure that a systematic and consistent process is used while PM&E measures are defined and evaluated. The evaluation topics described below are being addressed.

3.5.4.1 Reliability and Effectiveness

Part of the evaluation process is designed to assess whether or not the proposed PM&E measure would provide the hoped-for benefits, especially since most PM&E measures will have direct or indirect effects on other resources, could involve water supply and power generation losses, and would involve other costs to implement. The evaluation should be able to demonstrate that there is a high level of confidence that the proposed PM&E measure will help achieve specific resource goals, whether the goals are to reduce project-related impacts or to enhance environmental resources.



Source: Prepared by EDAW, Inc.

Figure 3.5-1. Developing the primary alternatives.

3.5.4.2 Conflicts with Other PM&E Measures

Another necessary step in the evaluation process involves determining whether the proposed PM&E measure may directly or indirectly conflict with other potential PM&E measures. For example, a PM&E measure that would increase minimum flow releases into the Feather River could be in direct conflict with a PM&E measure intended to maintain reservoir levels for recreation. Such conflicts must be identified and resolved at an early stage.

3.5.4.3 Effects on Other Environmental Resources

Most proposed PM&E measures would cause direct or indirect effects on other environmental resources. Some PM&E measures may also conflict with existing plans or policies. An important part of the analysis of PM&E measures is to identify the potential effects on other environmental resources or conflicts with plans and policies so that: (1) the advantages and disadvantages of the PM&E measure can be fully understood; and (2) the potential for modifying a PM&E measure to reduce or avoid the identified effects can be investigated. Evaluation of these factors will enable the potential benefits of, for example, new recreational facilities to be weighed against potential direct or indirect effects on other resources.

3.5.4.4 Effects on Power Generation, Water Supply, and Flood Control

There is also a need to understand what effects a proposed PM&E measure might have on water supply, flood control, and power generation. DWR needs this information to ensure that the resource benefits of PM&E measures are not outweighed by losses in water deliveries and the associated impacts related to reductions in SWP water supply. For example, PM&E measures that conflict with the flood control purposes of the Oroville Facilities may be determined to be infeasible.

3.5.5 Approach to Constructing the Proposed Action and its Alternatives

Figure 3.5-1 depicts the overall approach being used to construct a range of project alternatives. A broad array of potential PM&E measures are first being evaluated to determine whether they have a project nexus *and* help achieve specific resource goals. PM&E measures that pass the initial level of analysis are being carried forward into a more detailed definition and evaluation phase of analysis as described above. At the same time, operational modeling, including “sensitivity analyses,” is being conducted by DWR and the PDEA team’s engineering and operations modeling team to help determine the feasibility of PM&E measures that would affect project operations.

PM&E measures will be used to construct the primary action alternatives, including the Proposed Action, as required by NEPA, CEQA, and FERC guidelines. DWR will define and assess different combinations or “packages” of PM&E measures while constructing alternatives. The alternatives are expected to represent varying levels of environmental protection and enhancement. The No Action Alternative, which is the alternative that assumes that operations of the Oroville Facilities would continue under the terms and conditions of the existing FERC license, would have the least amount of environmental protection and enhancement.

3.6 DEFINITION OF THE PROPOSED ACTION AND ALTERNATIVES CARRIED FORWARD FOR FURTHER CONSIDERATION

The Proposed Action and other action alternatives are referred to in this document, and will be referred to in the January 2005 PDEA, as the "primary action alternatives." The primary action alternatives plus the No Project Alternative are collectively referred to as the "primary alternatives."

Once the range of primary action alternatives has been defined using the approach described in Section 3.5, each of these alternatives will be defined at a level of detail needed to support the related impact assessments to be conducted for the January 2005 PDEA. These definitions of the primary action alternatives will be summarized in a table and included in the January 2005 PDEA, along with the definition of the No Action Alternative.

3.7 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

The PDEA will describe a range of alternatives to the Proposed Action, and will explain why some of the alternatives were considered, but not evaluated in detail. The following identifies several alternatives raised by DWR, its consulting team, or the relicensing participants that are not proposed for detailed evaluation within the PDEA. In one form or another, these alternatives involve either transferring the operation and maintenance of the Oroville Facilities to another governmental entity or discontinuing power generation. None of these potential scenarios is considered reasonable or even remotely likely. Briefly discussed below are nonpower license, decommissioning, Oroville Dam removal and decommissioning, and federal takeover.

3.7.1 Nonpower License

The alternative in which FERC would issue a nonpower license is not proposed for detailed evaluation in the PDEA for several reasons. A nonpower license is a temporary license that FERC would terminate whenever it determines that another governmental agency will assume regulatory authority over and supervision of the lands and facilities covered by the nonpower license. FERC, under the authority of the Federal Power Act (FPA), allows licensees to apply for nonpower licenses, which permit the licensees to cease operation of their power generation facilities. When a licensee proposes to cease operation of these facilities, FERC regulations require that the licensee prepare an EA or EIS in accordance with NEPA, CEQ guidelines, and other applicable laws.

Furthermore, the licensee must provide information required under 18 CFR 16.11 including but not limited to: (1) a proposal that shows the manner in which the licensee plans to remove or otherwise dispose of the project's power facilities; (2) a proposal to repair or rehabilitate any nonpower facilities; and (3) a statement of the costs associated with removing the project's power facilities and with any necessary restoration and rehabilitation work.

Under this alternative, the nonpower license would continue to cover and address all of the Oroville Facilities, which include Lake Oroville, Oroville Dam, the Hyatt Pumping-Generating Plant, Thermalito Pumping-Generating Power Plant, Thermalito Diversion Dam Power Plant, Thermalito Forebay and Thermalito Afterbay, and associated recreational and fish and wildlife preservation and enhancement facilities. DWR could be required to maintain the recreational facilities, Feather River Fish Hatchery, and OWA.

Under a nonpower license, the three Oroville power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant) would remain in place, continue to operate for a limited amount of time, and eventually become inoperable. The dams and the powerhouse intakes would remain operable. The facilities could no longer be used to generate power, but they would retain their role in flood management, recreation, environmental purposes (fisheries and wildlife habitat enhancement), and water delivery (irrigation, salinity control, conditions in the Delta, etc.).

A termination of facility operations, temporary or otherwise, would have significant impact on power supply for the State's power grid by eliminating 762 MW, or roughly 2 percent, of the State's peak supply. Additionally, ancillary system benefits, including spinning reserves, peaking capacity, voltage regulation, and grid stability, would be lost, and the cost of developing replacement power would be considerable.

At this point, no agency has suggested a willingness or ability to assume regulatory authority and supervision over the lands and facilities covered by the nonpower license. No party has sought a nonpower license, and there is no basis for concluding that the Oroville Facilities should no longer be used to produce power. Additionally, a nonpower license would not support the primary purpose and needs of the Oroville Facilities that relate to electric power. Given this and the other factors outlined above, a nonpower license for the Oroville Facilities will not be considered further.

3.7.2 Decommissioning

The regulations pertaining to nonpower licenses under FERC, the FPA, NEPA, and the CFR as outlined above would also apply to decommissioning without dam removal.

Under the alternative of decommissioning without dam removal, the three Oroville power plants would be removed, the equipment salvaged or disposed of, and the powerhouse sites graded and restored. The dams and powerhouse intakes would remain operable. Similar to the arrangement under the nonpower alternative, the facilities could no longer be used to generate power, but they would retain their role in water supply, flood management, recreation, and environmental purposes. This alternative differs from the nonpower alternative described above in that the generation plants would be removed and become permanently inoperable.

Under 18 CFR 6.2, the licensee may surrender its license if it has satisfied all conditions imposed by FERC to protect the public interest, including those related to disposition of constructed facilities. The licensee is also required to file a schedule for the submittal of a surrender of license; file a surrender application according to the approved schedule; and provide for disposition of all project facilities. Where project facilities have been constructed on federal lands, the licensee must restore the project lands to a satisfactory condition and continue paying annual charges until the effective date of the order accepting surrender. Once decommissioning has been completed and the area has been restored to a satisfactory condition, FERC would no longer be involved with the Oroville Facilities.

The purpose of this action would be to decommission while maintaining the impoundment and the critical non-power related roles performed by the Oroville Facilities. If the dams are not removed, they would have to be maintained to prevent dam failures and the attendant threat to public safety. Additionally, the dams would need to be maintained to allow the Oroville Facilities to continue their role in flood management, recreation, environmental purposes, and water delivery.

Decommissioning would have a significant permanent impact on power supply to the State's power grid (see Section 3.7.1 above). Additionally, decommissioning would not support the primary purpose and needs of the Oroville Facilities that relate to electric power. Given this, and the fact that DWR has not indicated any willingness to maintain the dams as non-power producing dams, decommissioning of the Oroville Facilities has been eliminated from further consideration.

3.7.3 Oroville Dam Removal and Decommissioning

Under the dam removal and decommissioning alternative, Oroville Dam would be removed and the Hyatt Pumping-Generating Plant would be decommissioned.

The cost to remove the dam and power plant would be significant. Additionally, this alternative would not support the primary purpose and needs of the Oroville Facilities that relate to electric power, water supply, flood management, recreation, and environmental purposes. Removal of all dams associated with the Oroville Facilities would not meet the project purpose and needs, and would generate impacts similar to those described for removal of the main dam. Given these considerations, decommissioning facilities and removal of the dams included in the Oroville Facilities will not be evaluated further.

3.7.4 Federal Takeover

A federal department or agency may file a recommendation that the United States exercise its right to take over a hydroelectric power project with a license that is subject to §14 and §15 of the FPA. The recommendation must be filed no earlier than 5 years before the license expires and no later than the end of the comment period specified by FERC. Federal takeover and operation of the Oroville Facilities would require congressional approval as provided under §14 of the FPA. Furthermore, should a takeover occur, DWR must follow procedures relating to takeover and relicensing as outlined in 18 CFR, Part 16.

Although these facts alone would not preclude further consideration of this alternative, there is currently no evidence showing that a federal takeover should be recommended to Congress. No party has suggested that federal takeover would be appropriate, and no federal agency has expressed interest in operating the Oroville Facilities. Therefore, federal takeover of the Oroville Facilities will not be considered further.

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4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter provides study plans or “road maps” for each of the environmental analyses being conducted for the January 2005 PDEA. These analyses will be conducted once the Proposed Action and the other primary action alternatives have been defined. (The phrase “primary action alternatives” refers to the Proposed Action and the other action alternatives that will be assessed in detail for the January 2005 PDEA. The phrase “primary alternatives” refers to these same alternatives plus the No Action Alternative.) The analyses will use the results of ongoing technical studies and related modeling tools. Each of the road maps in this chapter includes a brief summary of the types and causes of potential impacts to be assessed, along with methods of analysis. As these analyses are completed, the potential consequences and affected environment related to each of the primary alternatives will be documented in Chapter 4.0 of the January 2005 PDEA.

To help readers of this document better understand the potential impact topics and methods of analysis likely to be addressed and employed by the environmental analyses in the January 2005 PDEA, the following important assumptions were used to complete the road maps contained in the subsections below:

- A range of PM&E measures will be included in the primary action alternatives and may include some or all of the following types of measures: construction of new recreation facilities, or construction or implementation of habitat improvement measures or programs.
- The primary alternatives may cause changes in reservoir levels, streamflows, water supplies, or hydroelectric generation.

It also is important to note that some of the potential impact topics included in the road map subsections below may not be applicable once the primary action alternatives are defined.

4.2 WATER USE AND HYDROLOGY

4.2.1 Types and Causes of Potential Impacts

The primary alternatives have the potential to change the operations of the Oroville Facilities, and therefore related water use and hydrologic regimes. Changes in Oroville Facilities operations could result in major changes in the magnitude, frequency, or duration of flows and water levels, which could have direct and indirect impacts on many other resources. For example, some elements of the primary alternatives could result in changes to future water surface elevations at Lake Oroville or Thermalito Afterbay and associated drawdown patterns, flood management operations, instream flow release rates in one or more locations, or flow release ramping rates. These changes will be evaluated for each resource to determine specific resulting impacts. The effects of each primary alternative on water use and hydrology will likely vary considerably with the availability of water. Therefore, each resource area will be evaluated by investigating impacts associated with five different hydrologic water year types (i.e., critical, dry, below normal, above normal, and wet).

The primary action alternatives are being developed to provide benefits to specific resources or groups of resources via PM&E measures. The evaluation of the effects of these alternatives and the No Action Alternative on water use and hydrology will be based on general relationships between elements of the primary alternatives, project operations, and the specific hydrologic conditions (i.e., water year type) and when they would occur. For example, changes in instream flow ramping rates downstream of Lake Oroville may be suggested as a way to benefit juvenile life stages of salmonid fish species in spring and early summer months. Hence, the direct and primary hydrologic effect would be observed during that time period. However, if additional storage releases are required to implement the action, reservoir elevation levels may decrease in the late fall and opportunities to meet hydropower generation demands or downstream water supply deliveries may be reduced. Studies will analyze the effect on all major resource areas so that a balanced assessment can be made.

In summary, and based on related FERC guidance, the following potential impact topics will be assessed:

- Ongoing effects of the project on Feather River streamflow, which consists of comparing “impaired” streamflows (i.e., streamflows with the project in place) and “unimpaired” streamflows (i.e., natural streamflow conditions);
- Effects on existing operations and related storage levels in Lake Oroville, Thermalito Forebay, and Thermalito Afterbay, Lake Oroville releases, and related flows downstream in the Feather River;
- Effects on groundwater quantity affected by operation of the Oroville Facilities (e.g., groundwater levels near Thermalito Afterbay, including the zone of groundwater and surface water interaction); and
- Effects on water supply availability (i.e., the projected water deliveries DWR would be able to make under each of the primary alternatives)

4.2.2 Methods of Analysis

This section describes the analytical modeling tools and evaluation procedures that are being used to investigate project-related effects on reservoir and river hydrology. Numerical modeling is being used to evaluate existing conditions and estimate the likely changes that are expected to occur under the No Action Alternative, each primary action alternative, and cumulative conditions. These hydrologic results will provide important information for the evaluation of water supply, power production, flood control, water quality, fisheries, recreation, and economic effects. A detailed discussion of how the hydrologic data will be used to support these evaluations is included in the "Methods of Analysis" subsections of Sections 4.3 through 4.23.

4.2.2.1 Operational Modeling

Oroville Facilities operational modeling tools (see Appendix D for details) were developed by DWR to evaluate the project-related operational effects of the primary alternatives. These models use the long-term inflows to Lake Oroville to simulate hourly, daily, seasonal, and annual water levels and flow release patterns for the Oroville Facilities reservoirs, and generation production amounts for the three power plants. The various models being used are briefly summarized below.

CALSIM II and HYDROPS

The CALSIM II and HYDROPS models are being used to simulate operation of the Oroville Facilities under varying conditions and assumptions. These models will generate information describing long-term planning scenarios and will provide information to allow environmental impact assessment for individual resource areas. Preliminary model runs are currently being made to support sensitivity analyses, and assessment of potential environmental effects that would result from a variety of possible project operational changes.

The following narrative describes the CALSIM II and HYDROPS models.

- **CALSIM II.** CALSIM II is an operations and planning model used by the USBR, DWR, and others to simulate the complex integrated operations of the SWP, CVP, and other facilities and project operations that affect the Delta, including facilities on the east side of the Central Valley. It allows for assessment of potential water supply and surface water hydrology impacts on an annual and monthly time step basis, and by water year type.
- **HYDROPS.** HYDROPS, developed by Powel Technology, Inc., is a model used to simulate local Oroville Facilities operations with the goal of maximizing hydropower production within the constraints imposed by water delivery and flood control operations.

Other Resource Evaluation Models

Additional models are being used to assess the effects of the resulting project operations on specific resource areas. These resource models include a water temperature model; a scour, erosion, and sediment transport model; an aquatic habitat model; and a terrestrial habitat model. In addition, recreation models are being used to evaluate the effects of reservoir level, river flow, and water temperature conditions.

Economic and fiscal impact models are being used to evaluate potential economic impacts on affected industrial sectors, or elements of the local economy, and local government.

Appendix D, Modeling Tools, provides a more detailed description of models, assumptions, and modeling procedures being used in the development of information for the environmental analyses and impact assessments.

4.2.2.2 Model Integration

The Oroville Facilities operational models are designed to integrate with specific resource models to perform required evaluations. The operational models provide information to the resource models that can provide feedback to incorporate results into the additional development of the operational models. The modeling process for each primary alternative is generally as follows:

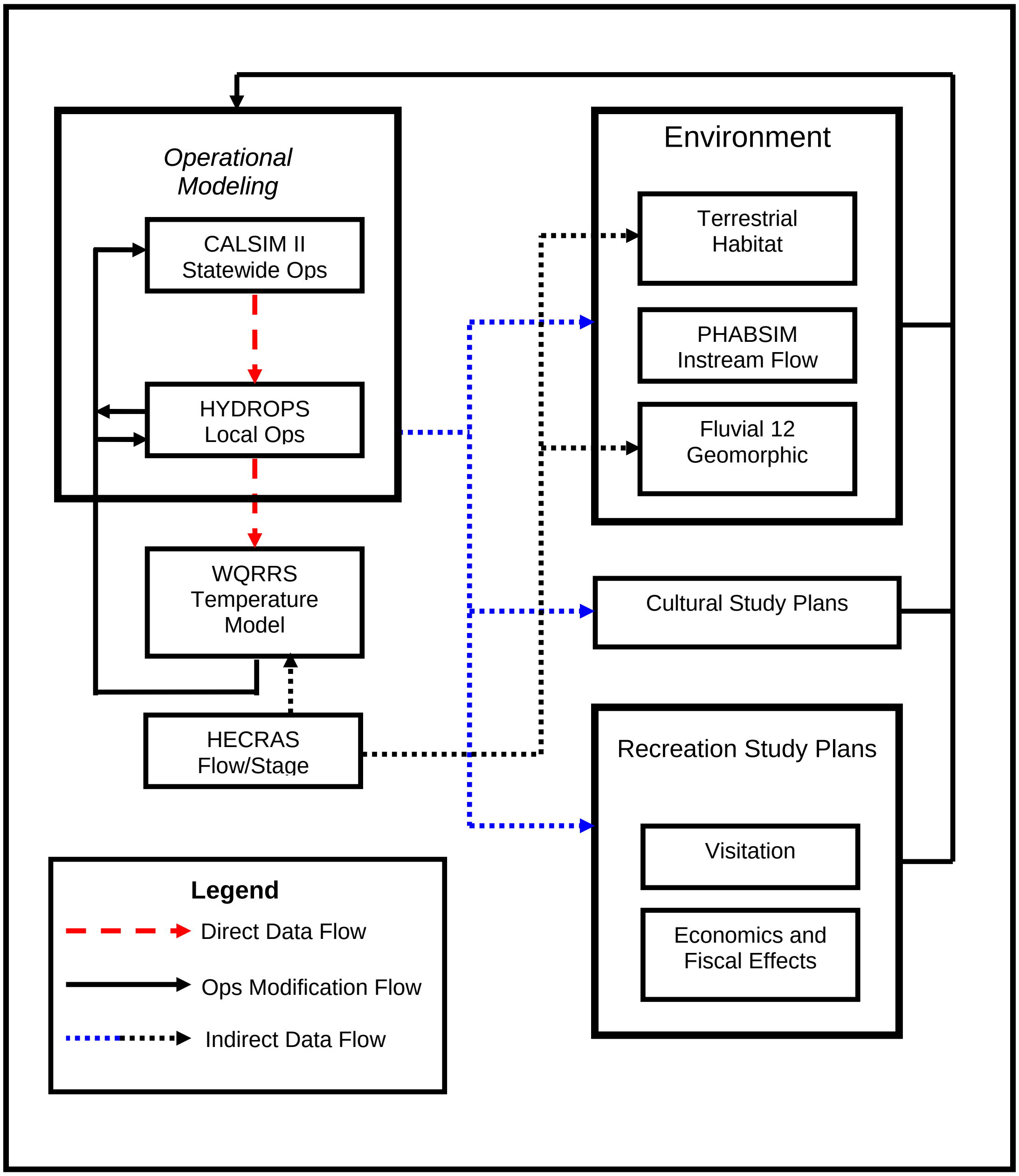
- **Step 1: CALSIM II Operational Modeling.** CALSIM II modeling is used to develop water supply based operational constraints to be used as input for the HYDROPS model and other resource models and evaluations.
- **Step 2: HYDROPS Operational Modeling.** HYDROPS modeling is used to evaluate operational impacts of the Oroville Facilities that cannot be fully determined by CALSIM II modeling.
- **Step 3: Resource Modeling and Evaluations.** Hydrologic information describing simulated Oroville Facilities operations determined through operational modeling (Steps 1 and 2) is developed for specific resource models and evaluations as required. The resource models and evaluations are then used to provide specific information on impact assessment and to provide operational model feedback that can be used to improve the primary alternatives.

A flow chart illustrating the interactions of the operational models and resource models and evaluations is shown in Figure 4.2-1. Specific resource modeling and evaluations may provide information that requires the investigation of additional Oroville Facilities operational conditions, which in turn may require additional evaluations using the operational models.

4.2.2.3 Operational Scenarios for Impact Assessment

<u>Year 2001 and 2020 Level of Development</u>

Using CALSIM II and HYDROPS operational models, an Existing Conditions Benchmark Study was developed that represents the current Oroville Facilities and operational criteria under the 2001 level of development conditions. The 2001 level of development conditions are those that were experienced in year 2001.



Source: DWR.

Figure 4.2-1. Model Interaction and Data Flow.

To represent future conditions, the No Action scenario is used based on anticipated facilities and operations that would be present at the year 2020 level of development. These scenarios, representing the existing baseline and future No Action conditions, were developed by modifying CALSIM II benchmark studies originally prepared by DWR in 2002 (DWR 2002).

The Existing Conditions Benchmark Study and No Action scenario represent operation of the Oroville Facilities that would be expected without implementation of new PM&E measures. The primary action alternatives will include PM&E measures based on results of specific resource evaluations. To enable evaluation of a full range of potential impacts, and to comply with NEPA and CEQA, the primary action alternatives will be evaluated with comparisons to both existing conditions and future conditions under the No Action Alternative. A summary of the operational scenarios to be considered for impact assessment is shown in Table 4.2-1.

Table 4.2-1. Operational scenarios for impact assessment.

Operational Scenarios	Key Components and Assumptions	
	Level of Development (Year)	PM&E Measures Included?
Existing conditions	2001	No
No Action	2020	No
Proposed Action	2020	Yes
One or more primary alternatives	2020	Yes

Source: DWR.

Because of comprehensive, regionwide environmental studies conducted by other agencies that are ongoing or have yet to be fully resolved through court-ordered decision and/or settlement processes, many regulatory standards and assumptions regarding operations criteria are required for development of the operational scenarios. Appendix D, Modeling Tools, discusses these ongoing issues and provides a more detailed description of models, assumptions, and modeling procedures used in the development of the operational scenarios for evaluation of the Oroville Facilities within that context.

Use of Modeling Results for Impact Assessment

Operational modeling will provide information to help evaluate and compare the impacts of the primary alternatives. Operational modeling output will include information describing reservoir elevation and storage, river flow, water temperature, water supply deliveries, and SWP and CVP exports from the Delta. The types of hydrologic information produced by the modeling that in turn will be used in the impact assessments conducted by other resource areas include average monthly streamflow, mean and maximum daily streamflow, flow duration curves, annual streamflow hydrographs, and reservoir elevations. This more detailed hydrologic information will be used to identify the magnitude and trends of specific resource impacts and will be customized to meet the needs of individual resource areas.

The effects of the primary alternatives on water supply availability will vary with the availability of water and the many DWR commitments defined in Section 3.3. The availability of water is assessed by using hydrologic water year types. Water year types will be grouped according to the Sacramento Valley water year type definitions (Table 4.2-2).

Table 4.2-2. Sacramento Valley water-year types.

Year Type	Water Year Index
Wet	Equal to or greater than 9.2
Above Normal	Greater than 7.8 and less than 9.2
Below Normal	Greater than 6.5 and equal to or less than 7.8
Dry	Greater than 5.4 and equal to or less than 6.5
Critical	Equal to or less than 5.4

*Notes: Water year index = [0.4 * current April–July runoff forecast (in maf)] + [0.3 * current October–March runoff (in maf)] + [0.3 * previous water year's index]. (If the previous water year's index exceeds 10.0, then 10.0 is used.) This index, originally specified in the 1995 SWRCB WQCP, is used to determine the Sacramento Valley water year type as implemented in SWRCB Decision 1641 (D-1641). Year types are set by first-of-month forecasts beginning in February. Final determination is based on the May 1 50 percent exceedance forecast.*
Source: DWR Website.

CALSIM II and HYDROPS modeling evaluations provide information that is intended for use in comparing the results of one operational scenario against another in a fashion that isolates the impact of specific elements of the operational scenario related to the alternative being assessed. For the impact analysis, the existing conditions and future No Action Alternative conditions represent important points of comparison to the conditions associated with each action alternative. The resulting operational model output will provide information on potential impacts related to reservoir elevation and storage, river flow, water supply deliveries, and SWP and CVP exports from the Delta.

4.3 FLOOD MANAGEMENT

4.3.1 Types and Causes of Potential Impacts

As further described in Section 3.3, during the period of October to March the Oroville Facilities are to be operated in conformance with the flood control regulations prescribed by the Secretary of the Army under the provisions of the Flood Control Act of 1944 (58 Stat. 890; 33 USC 709) and related agreements between DWR and the USACE. All operations during October to March each year must conform to the flood control diagram (see Figure 3.3-3) and the emergency spillway release diagram in the flood operations manual for Lake Oroville (which are consistent with applicable regulations and agreements).

It is possible that a primary alternative, while still within the parameters set by the flood control diagram, may increase the existing level of downstream flood protection below Oroville Dam. Alternatives specifically designed to increase the existing level of downstream flood protection will not be evaluated in this document. However, any primary alternative must be designed so that it does not decrease the existing level of downstream flood protection.

4.3.2 Methods of Analysis

Operations modeling will be necessary to evaluate the effect of each primary alternative on the flood release capability of Oroville Dam. CALSIM II will be used to simulate changes in operation for each alternative relative to existing conditions, and to help determine whether the changed operation could affect DWR’s ability to meet flood management objectives under the 1944 Flood Control Act. The ongoing, flood-related effects of the Oroville Facilities will also be summarized as part of the assessment of the No Action Alternative. This discussion will summarize key historical events and provide a brief overview of how the Oroville Facilities have reduced both the magnitude and frequency of flooding downstream of Oroville Dam since it was constructed.

4.4 POWER GENERATION AND CAPACITY

4.4.1 Types and Causes of Potential Impacts

The primary alternatives have the potential to change the future level of hydroelectric power generation and available capacity at the Oroville Facilities by causing changes in existing reservoir drawdown levels, flow release rates, or flow ramping rates, all of which would affect the magnitude and timing of future generation from the existing three power plants. Changes could also affect the amount of income derived by DWR through participation in the ancillary services market (i.e., the California ISO). All of the primary alternatives could affect average annual power generation and available capacity at the plants and could result in impacts on other resource areas such as socioeconomics and air quality. The results of the power generation impact analysis also will be an important input into the Developmental and Economic Analysis, which will consider power economics (see Chapter 6.0).

The analysis of potential impacts on power generation and capacity will consider:

- The effects of different flow ramping rates, reservoir operation plans, and other factors on power generation and available firm power capacity (other factors to be considered include timing, magnitude, and duration of flows; pump-back and maintenance scheduling; and hatchery operations);
- The availability of replacement power and identification of likely sources of such power if output from the Oroville Facilities is reduced;
- Potential impacts on DWR’s ability to continue to participate in the ancillary services market providing benefits to the regional power grid; and

- The potential for DWR to avoid reduction in the project's power benefits as a result of implementation of an alternative that reduces its total output, through improved and coordinated operation of the Oroville Facilities with other agencies and utilities.

4.4.2 Methods of Analysis

Operations modeling, engineering studies, and economic modeling have been conducted by DWR in support of the Oroville Facilities relicensing. The results of the modeling and studies described below will be presented in the analysis to help assess the impacts of the primary alternatives on future power generation and available capacity.

- *Hydrology and Operations Modeling:* Hydrology and reservoir operation models (CALSIM II and HYDROPS) were developed by DWR between 2000 and 2003 to evaluate the primary alternatives being assessed for the January 2005 PDEA. These models simulate the hourly, daily, seasonal, and annual flow patterns and hydroelectric generation amounts for the reservoirs and power plants that are part of the licensed facilities.
- *Study Plan (SP) E-3, Evaluate the Potential for Additional Hydropower Generation at Oroville.* This report has been prepared to document the results of work conducted to assess the viability of making future generation improvements or additions at the Oroville Facilities. These studies have produced important economic data and other information that can be used to better understand the relationship between factors that would require changes in operation and related effects on future energy output, available capacity, and ancillary benefits.
- *Economic Analyses (Methodology for Developmental Analysis).* Economic analyses are being performed for the primary alternatives based on the methodology prescribed by FERC in its published Guidelines for conducting developmental analyses in support of a FERC license application.

4.5 AESTHETIC RESOURCES

4.5.1 Types and Causes of Potential Impacts

The aesthetic/visual quality of an area is influenced by a variety of factors. These include features in the landscape (landforms, vegetation, land uses, and human-made structures) as well as climate, sounds, and smells. All of these factors can enhance or detract from the experience of a place. This section focuses on visual resources; the other factors are addressed in Section 4.7, Air Quality, and Section 4.14, Noise. The primary action alternatives have the potential to affect visual resources in the study area. The analysis of potential impacts on visual resources will consider actions that would result in:

- Changes in existing pool elevation patterns at Lake Oroville, Thermalito Forebay, and Thermalito Afterbay that could expose previously submerged, unvegetated shoreline areas at different time periods than are currently exposed under the existing operating regime and could create variability in the visible “bathtub ring” effect, particularly during peak visitation periods;
- The introduction of new infrastructure or recreation facilities where they would create a noticeable change in, or conflict with, the area’s existing visual character or scenic quality;
- New sources of light or glare from new buildings or facilities, and other concerns related to glare;
- Short-term loss of vegetation associated with construction activities;
- Short-term effects on visual quality associated with construction activities;
- Effects of invasive species on the appearance of project lands;
- Landscaping, restoration, preservation, vegetation, facilities management, and/or maintenance programs (i.e., removal of trash and project debris) for aesthetic enhancement of project lands;
- New construction and maintenance debris and new patterns of trash accumulation from new recreational facilities; and
- The potential visual effects on flowing water, substrate, and shorelines from any changes in downstream flow regimes and requirements.
- Ongoing aesthetic effects of the project will also be defined.

The analysis of visual impacts is somewhat subjective, as sensitivity to changes in the visual environment varies and individuals respond differently to these changes. However, the thresholds defined below will be used to guide the analysis.

4.5.2 Methods of Analysis

Current operations and their impacts on aesthetic resources will be summarized from the results of SP-L4, Aesthetics, to establish baseline conditions and help define related ongoing effects of the project. The existing aesthetic conditions will be displayed in an appendix to the January 2005 PDEA.

Changes in operations under the primary alternatives (if any) may result in different timing of reservoir drawdowns and different elevations compared to current operations. The analysis will compare alternatives by examining and comparing rule curves and explaining the differences at key observation points (KOPs) developed as part of SP-L4 at different times of year compared to the current regime. This will be accomplished by using either geographic information systems (GIS) analysis and/or photographs of

KOPs at various pool elevations. There will also be qualitative discussions comparing changes.

The status of current DWR debris sites and equipment storage areas will be discussed and methods for reducing the impact to aesthetic resources associated with these facilities will be offered.

If descriptions of facilities associated with proposed PM&E measures are available, the potential impacts of those facilities will be discussed along with methods for reducing the aesthetic resource impacts associated with the proposed PM&E measures. The discussion will not be detailed, but will help highlight potential concerns about visual resources associated with the implementation of any PM&E measures.

4.6 AGRICULTURAL RESOURCES

4.6.1 Types and Causes of Potential Impacts

Land use surrounding the Oroville Facilities includes urban and built-up land, grazing land, and irrigated and nonirrigated crops. Agriculture production is a mainstay of Butte County’s economy; however, increasing population pressures in the county cause conversions of farmland to urban uses. Of the 917,909 acres mapped in Butte County, 522,297 acres were in agricultural use; 40,185 acres were urbanized; 21,643 acres were water; and 333,784 acres were Other (DOC Website). Near the north end of Thermalito Afterbay is an area of dryland grain cropland less than 30 acres in size. Crop types that occur downstream of Thermalito Afterbay along the Feather River include field crops, pastureland, grain and hay, and fruit and nuts. Thermalito Afterbay provides recreational opportunities, provides a facility for diversion of water for agricultural use, releases water into the lower Feather River, and provides storage during pump-back operations. Several local irrigation and water districts divert water from Thermalito Afterbay, as well as directly from the Feather River below the Thermalito Afterbay outlet. Hence, the primary alternatives could affect agricultural resources.

The analysis of potential impacts on agricultural resources will consider:

- Effects on farmland from taking agricultural land out of production by constructing new facilities associated with implementation of a new hydropower license;
- Effects on aquatic vegetation (e.g., tamarisk, purple loosestrife) entering agricultural canals from Thermalito Afterbay (see also Section 4.9, Botanical Resources); and
- Other effects on agricultural resources.

4.6.2 Methods of Analysis

Implementation of the primary action alternatives is anticipated to produce two distinct types of effects within the local and regional study area: direct effects related to construction activities or changes in Oroville Facilities operations, and indirect effects related to changes in hydrologic conditions.

The methods of analysis used to evaluate potential effects on agricultural resources will utilize both quantitative and qualitative assessment techniques. The assessment will begin by describing ongoing effects and other aspects of the affected environment related to agricultural resources that could be influenced by implementation of the primary action alternatives.

To evaluate potential impacts of existing and future project operations on the productivity of agricultural crops, the Thermalito Complex Temperature Model developed as part of SP-E1.4, Thermalito Complex Temperature Model Development, will be used to determine changes in water temperatures at the agricultural diversion points associated with the Oroville Facilities under alternative operational scenarios. The water temperature records in the agriculture conveyance systems will also be used to evaluate the relationship of water temperatures at the agricultural diversions to those locations where agricultural-related beneficial uses occur. These two data sets will be used to determine water temperatures under the baseline condition and with implementation of the primary alternatives. Temperature data output from the model will be used to analyze the current and potential future project operation effects on the thermal regime of agricultural water diversions. These model results will be compared to water temperature thresholds recommended for rice production to evaluate potential project-related effects.

Using the well log data from SP-W5, Project Effects on Groundwater, an analysis of groundwater levels surrounding Thermalito Afterbay will be completed. Groundwater tables reported in SP-W5 will be evaluated against thresholds for minimum water table depth for production of permanent and field crops. Changes in operations from the baseline condition resulting from implementation of the primary alternatives will be evaluated to assess each alternative’s contribution to groundwater recharge and the resulting potential impacts on agricultural crop production.

Any prime farmland in the project area will be identified, as delineated by agencies such as the Natural Resources Conservation Service using factors such as soil type. Once such farmland is identified, the potential conversion of prime farmland as a result of proposed construction activities or from erosion caused by project operations will be determined for each of the primary action alternatives. Conversion of prime farmland will be quantitatively evaluated based on proposed construction designs. Potential conversion of farmland as a result of erosion caused by project operations will be qualitatively evaluated based on results from SP-G2, Effects of Project Operations on

Geomorphic Processes Downstream of Oroville Dam, which uses the FLUVIAL-12 model.

A qualitative evaluation will be conducted of potential impacts on agricultural operations from changes in proposed recreation activities, facilities, and visitation associated with implementation of the primary action alternatives.

4.7 AIR QUALITY

4.7.1 Types and Causes of Potential Impacts

Implementation of the primary action alternatives, including the possible construction of facilities or implementation of habitat improvements associated with PM&E measures, could result in air quality impacts. Recreational and maintenance vehicles traveling on unpaved roads in the OWA could increase airborne dust, or particulates, along unpaved roads; vehicles and equipment associated with construction activities could lead to an increase in nitrogen oxide (NO_2), sulfur oxide (SO_2), and other emissions.

If one of the primary alternatives cause a reduction in hydroelectric power generation, and it is anticipated that the replacement sources would be fossil fuel–generated plants, the related air quality effects of such power impacts also will be assessed.

4.7.2 Methods of Analysis

Increases in short-term regional emissions associated with the Oroville Facilities relicensing will be estimated based on anticipated construction equipment/usage requirements using USEPA AP-42 emission factors. The specific types of construction equipment required for implementation of the primary alternatives are not known at this time. Therefore, the assessment of short-term emissions will be based on equipment typically required for similar projects.

Long-term increases in emissions would be associated primarily with increased levels of visitation and recreational use activities (e.g., watercraft). Changes in recreation-related emissions, including emissions from on-highway motor vehicles and watercraft, will be calculated based, in part, on mobile source emission factors obtained from ARB and watercraft usage data obtained from ARB for Butte County. The potential for localized emissions of mobile source carbon monoxide, diesel exhaust particulates, and odors to affect nearby sensitive receptors will also be assessed qualitatively, based on proximity to the proposed activities.

Typical fossil fuel power plant emission data available from USEPA and published California Energy Commission reports will be used to quantify the potential emissions from such plants if they are expected to be the source of replacement power needed due to the power impacts of a primary alternative.

4.8 AQUATIC BIOLOGICAL RESOURCES

Operation of the Oroville Facilities influences environmental conditions within several water bodies supporting fisheries and other aquatic resources. Aquatic biological resources to be evaluated are fish species in the study area that are of primary management concern because they fall into one or more of the following categories:

- Recreationally or commercially important species (fall-run Chinook salmon, steelhead, American shad, black bass, striped bass, and coho salmon);
- Species that are State listed under CESA and/or federally listed under FESA (spring-run Chinook salmon and Central Valley steelhead);
- Candidate species for listing under CESA and/or FESA (fall-run Chinook salmon and green sturgeon); and
- State species of special concern (fall-run Chinook salmon, Sacramento splittail, green sturgeon, river lamprey, and hardhead).

4.8.1 Types and Causes of Potential Impacts

The species listed above may be affected by the primary alternatives directly and/or indirectly by alterations primarily related to reservoir storage, coldwater pool and surface water levels, river flows, stage elevations, and water quality parameters, including water temperature. Reduced water levels in Lake Oroville during the spring spawning periods could adversely affect spawning by and survival of the eggs and larvae of warmwater species (including largemouth, smallmouth, and spotted bass), or the coldwater pool for freshwater species (including rainbow and brown trout and coho salmon). Seasonal variation in Feather River streamflows may affect the quality and quantity of spawning or rearing habitat, or may interfere with upstream or downstream fish migration. Changes in water temperatures may affect spawning and rearing success of anadromous salmonids (e.g., Chinook salmon and steelhead), as well as survival and growth during various life stages, migration timing and success, species distribution, and habitat use. Physical barriers (e.g., periodic sedimentation, dam structures, and low flows at critical riffles) can affect the movement of aquatic biological resources by preventing fish passage to upstream tributaries, as well as blocking upstream recruitment of gravel and woody debris to the lower Feather River, which may affect the quality of fish habitat. In addition, recreation-related activities, including angling, can affect fish populations through increases in harvesting or potential disruption of habitat by fishermen.

The analysis of potential impacts on aquatic biological resources will consider:

- Effects of existing and future project operations during all water year types on the behavior (e.g., migration timing, microhabitat selection), reproduction, and survival (vulnerability to predators) of warmwater and coldwater fish and other aquatic resources (e.g., macroinvertebrates) within project-affected waters.

Operational factors to be considered include power generation; water storage, ramping rates, and releases; pump-back operations; and water level fluctuations.

- Effects of existing and future project operations and fisheries management activities on the establishment, transmission, extent, and control of the infectious hematopoetic necrosis (IHN) virus, bacterial kidney disease (BKD), and other significant diseases affecting coldwater and warmwater fish within Lake Oroville and other project-affected waters. Activities to be considered include pump-back operations, hatchery production, water temperature, and fish stocking programs.
- Effects on the quantity and quality of habitat supporting resident fish (e.g., trout, other salmonids, and warmwater fish) and other aquatic species within project-affected waters. Factors to be considered include instream flows, sediment distribution, erosion, woody debris recruitment, water temperatures, water levels of Thermalito Forebay and Thermalito Afterbay, and associated changes in water quality.
- Effects of project structures or operations on fish passage from Lake Oroville into upstream tributaries and within other project-affected waters.
- Effects of existing and proposed fisheries management plan(s) and activities on a balanced coldwater and warmwater fishery. Factors to be considered include stocking levels, hatchery management and production relative to in-river populations, habitat enhancement projects, control of predator and undesirable species and prevention of future introductions (e.g., Northern pike), disease management, and harvest rates.
- Effects on fish species listed as Threatened and/or Endangered under CESA and/or FESA, candidate species for listing under CESA and FESA, State species of special concern, and the habitat needed to support them;
- Effects on interactions, including predation and competition, among lake and tributary fish populations (e.g., landlocked Chinook and coho salmon, trout, black bass, and other landlocked species) that affect species abundance, growth, reproduction, and survival.
- Effects of the Feather River Fish Hatchery on salmonid populations in the Feather River watershed and other Central Valley tributaries and within other project-affected waters. Factors to be considered include straying, genetic impacts, harvest rates, disease, temperature requirements, and interactions with native fish associated with predation and competition.
- Effects of existing and future project facilities and operations (e.g., instream flows, water temperature, ramping rates, and stage elevations) on anadromous fish and other native resident fish habitat and populations. Factors to be considered include riparian habitat; recruitment of large woody debris; predation; spawning gravels; juvenile stranding and redd dewatering; the macroinvertebrate

prey base; upstream and downstream passage; and holding, spawning, and rearing conditions.

- Compliance of project operations with current operating agreements and biological opinions and adequacy of constraints to protect anadromous fish and other aquatic species in the low-flow channel and in the Feather River downstream of Thermalito Afterbay.
- Effects of existing and future project facilities and operations on the abundance of predators, their seasonal and geographic distribution, the impact of predation mortality on population dynamics of salmonids and other species, and alternatives for predator control and management (including prevention of introductions).
- Effects of existing and future project facilities and operations on genetic introgression of fall-run and spring-run Chinook salmon in the lower Feather River; the feasibility of alternative operational and engineering strategies to reduce/prevent potential introgression will be evaluated.
- Effects on fish entrainment and impingement associated with pumping operations and water diversions.
- Direct effects of recreational activities, including angling, on fish mortality, and indirect effects associated with disruption of fish habitat.

4.8.2 Methods of Analysis

Implementation of the primary alternatives could produce two distinct types of effects within the local or regional study area: Direct effects related to construction activities or changes in Oroville Facilities operations, and indirect effects related to changes in hydrologic conditions.

Both quantitative and qualitative assessments will be completed to evaluate potential effects on aquatic resources. The effect assessment will be initiated by describing those aspects of the affected environment related to aquatic resources that could be influenced by implementation of any of the primary alternatives. Fish species and habitat parameters within the study area will be discussed generally, and fish species of primary management concern that will undergo detailed analyses will be identified. As described in Section 4.8.1, fish species of primary management concern are those species within the study area that are listed pursuant to FESA and/or CESA, or are recreationally or commercially important.

Specific biological indices for species of primary management concern will be identified based on literature review and study plan results. Types of literature examined will include scientific journals, Master's theses and Ph.D. dissertations, and agency publications.

Such indices will be related to required or preferred river flows and stage elevations, reservoir water surface elevations, coldwater habitat volumes, and water temperatures during specific life stages (i.e., adult immigration; spawning, egg incubation, and initial rearing; and juvenile rearing and emigration). Effect indicators and evaluation criteria will be developed based on these biological indices and used in the evaluation of each alternative's potential effects on the species of primary management concern.

For analyses of fisheries and aquatic resources, effect indicators such as water temperature, flows, nest dewatering events, and availability of littoral habitat will be used to evaluate whether the primary alternatives would have an adverse effect on a species' habitat or range. Exceedance of monthly mean water temperatures for certain species life stages (65°F from November through June for juvenile rearing and emigrating spring-run Chinook salmon) is one such effect indicator. Reductions of reservoir water surface elevations can reduce the availability of nearshore littoral habitat used by warmwater fish for spawning and rearing, thereby reducing spawning and rearing success and subsequent year class strength; therefore, reservoir water surface elevation is another effect indicator that will be used. In addition, decreases in reservoir water surface elevations during the primary period for nest building by warmwater fish may result in reduced initial class strength through warmwater fish nest "dewatering." Changes in river flows and water temperatures during certain periods of the year have the potential to affect spawning, egg incubation and initial rearing, and juvenile rearing and emigration. Therefore, changes in monthly mean river flows and water temperatures during certain times of the year (coinciding with the timing of spawning, egg incubation, and initial rearing) will also be used as effect indicators.

Hydrologic and water temperature modeling will be performed to provide a quantitative basis from which to assess potential effects of the project alternatives on fisheries resources and aquatic habitats in the study area. Potential effects associated with implementation of the primary alternatives will also be analyzed on a qualitative basis, often in relation to the results of the hydrologic modeling.

Modeling output will provide monthly values for each year of the hydrologic simulation period modeled for river flows and stage elevations, reservoir storage and elevation, and water temperatures. Resource assessments will be based on comparisons made between computer model simulations that represent hydrologic conditions under existing, No Action, Proposed Action, and other action alternative conditions. The models will provide an index of the kinds of changes that would be expected to occur with implementation of a specified set of operational conditions. For example, output for the primary alternatives will be compared to that for the baseline condition simulation to determine:

- Whether reservoir storage or river flows and water temperatures would be expected to change with implementation of any of the primary alternatives;

- The months in which potential reservoir storage and river flow and water temperature changes could occur; and
- A relative index of the magnitude of change that could potentially occur with implementation of any of the primary alternatives.

Other habitat parameters not related to potential changes in river flows and stage elevations, reservoir storage and elevation, and water temperatures will be evaluated qualitatively based on literature reviews and study plan results. These include potential effects associated with fish interactions (e.g., competition for food or habitat, species introgression, predation), management-related effects (stocking program and disease management), restoration of fish passage from the lower Feather River to Lake Oroville, and potential effects on macroinvertebrate populations, energy and nutrient transfer, woody debris distribution, and gravel recruitment.

The results of the quantitative and qualitative analyses of flow regime changes described in Section 4.11, Geology and Geomorphology, will be evaluated qualitatively for potential impacts on the development, maintenance, and natural succession of fish habitat quality, quantity, and distribution. There will also be a qualitative evaluation of alterations in the magnitude, duration, and frequency of flow events in the lower Feather River that determine how geomorphic processes would influence fish habitats with implementation of the primary alternatives. The following specific elements will be evaluated:

- Changes in the relative proportions of types of mesohabitat (a discrete area of stream exhibiting relatively similar characteristics) by river reach;
- Pool formation and maintenance, for suitability of pool habitat depth;
- Incision and entrenchment of the streambed as it affects access to floodplain habitat;
- Sediment suspension and recruitment as it affects bench formation for riparian vegetation succession, and its contribution to fish habitat cover;
- Recruitment and mobilization of spawning gravels;
- The effect of armoring and winnowing of smaller aggregate sizes on the suitability of spawning gravels;
- Bank cutting and erosion for potential recruitment of large woody debris for fish habitat cover;
- Upstream recruitment or placement of large woody debris for fish habitat cover, and its contribution to the capture and retention of sediment for formation of benches colonized by riparian vegetation, which in turn are used by fish as habitat and cover; and

- River stage elevation and its effect on pond recharge and fish habitat in the OWA.

Influences of geomorphic processes on fish habitats in Lake Oroville and its upstream tributaries and the Thermalito Complex will be evaluated qualitatively for:

- The rates at which sediment deposition and erosion from upstream tributaries reach the reservoir elevation and the resulting effect on fish passage from the reservoir into the upstream tributaries; and
- Effects of landslides on fish habitat in the reservoir.

Changes in project operations from baseline conditions to primary alternative conditions will be analyzed quantitatively and qualitatively to identify potential impacts on macroinvertebrate composition and population, and resultant effects on the fish food base. Macroinvertebrate composition and population can affect the availability of food for predatory fish species and other fish species and life stages. The results of analyses from Section 4.22, Water Quality, also will be evaluated qualitatively to identify potential impacts on macroinvertebrate populations. These evaluations will include:

- Changes in the amount of water surface area in relationship to macroinvertebrate populations, and the resulting potential impacts on fish food supplies;
- Changes in water temperatures in relationship to macroinvertebrate production and composition, and the resulting potential impacts on the fish food base; and
- Changes in water quality (i.e., turbidity, nutrient levels) in relationship to macroinvertebrate production and composition, and the resulting potential impacts on the fish food base.

As a basis for the assessment, projected physical and chemical changes associated with future project operations will be compared with ecological requirements for macroinvertebrates and plankton populations within project-affected waters. A qualitative assessment of potential impacts will be conducted that determines the general direction of such impacts.

The resultant magnitude, duration, and frequency of the identified change in the effect indicator and/or habitat parameter will be evaluated using professional judgment to determine whether the change would be expected to result in effects on aquatic resources within the study area. The total anticipated effects from the evaluations of each life stage will be compared with the significance criteria to ascertain whether the Proposed Action or project alternative would result in potentially beneficial, less than significant, or significant adverse impacts on each species of primary management concern.

Analysis of potential effects on aquatic resources will rely on the results of the following study plan reports:

- SP-F1, Evaluation of Project Effects on Non-fish Aquatic Resources;
- SP-F2, Evaluation of Project Effects on Fish Diseases;
- SP-F3.1, Evaluation of Project Effects on Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area;
- SP-F3.2, Evaluation of Project Effects on Non-salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam;
- SP-F5/7, Evaluation of Fisheries Management on Project Fisheries;
- SP-F8, Transfer of Energy and Nutrients by Anadromous Fish Migrations;
- SP-F9, Evaluation of the Feather River Hatchery Effects on Naturally Spawning Salmonids;
- SP-F10, Evaluation of Project Effects on Salmonids and their Habitat in the Feather River Below the Fish Barrier Dam;
- SP-F15, Evaluation of the Feasibility to Provide Passage for Targeted Species of Migratory and Anadromous Fish Past Oroville Facility Dams;
- SP-F16, Evaluation of Project Effects on Instream Flows and Fish Habitat;
- SP-F21, Project Effects on Predation of Feather River Juvenile Anadromous Salmonids;
- SP-E1, Model Development;
- SP-E6, Downstream Extent of Reasonable Control of Feather River Temperature by Oroville-Thermalito;
- SP-E8, Temperature Impacts of Pumpback Operation on Oroville Reservoir Cold Water Pool;
- SP-G1, Effects of Project Operations on Geomorphic Processes Upstream of Oroville Dam;
- SP-G2, Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam;
- SP-W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Waters;
- SP-W2, Contaminant Accumulation in Fish, Sediments and the Aquatic Food Chain; and
- SP-W6, Project Effects on Temperature Regime.

4.9 BOTANICAL RESOURCES

This section addresses plant communities, including wetlands and other water dependent communities, and special-status plants. Special-status plants are separated into two groups:

- Species listed as Threatened, Endangered, or Rare (listed species) by the CESA and/or FESA; and
- Species that are recognized by resource agencies or groups (i.e., CNPS) or regulatory or land management agencies as requiring protection and special consideration because of their uniqueness, declining status, limited distribution, or sensitivity to potential impact.

4.9.1 Types and Causes of Potential Impacts

The primary alternatives have the potential to affect botanical resources in the study area. Existing dams and hydroelectric facilities may cause direct and indirect impacts on botanical resources from the following:

- *Changes in reservoir water levels:* Water levels in reservoirs fluctuate in response to needs for power production, flood control, and water withdrawals for irrigation or municipal water use. Daily and seasonal fluctuations in water levels generally favor the establishment of upland plant communities along the shoreline instead of riparian vegetation more typically associated with natural lakes. The zone exposed in late summer, fall, and winter by reservoir drawdown usually does not support vegetation. Areas exposed by a spring/early summer drawdown may support some vegetation if conditions are favorable, but plant diversity is often low and can be dominated by non-native, weedy species.
- *Altered discharge to streams and rivers:* Dams and hydroelectric project operations affect downstream hydrology by altering flow magnitude, timing, and duration. Fisheries operations and other procedures to accommodate the needs of specific species may also affect the timing and quantity of hydrologic flows. These hydrological variations often change the extent, species diversity, and structure of riparian communities downstream of the hydroelectric project, and may affect ecological processes such as nutrient exchange, sediment delivery, erosion, and seed dispersal. In addition, hydroelectric project operations can affect wetlands and vernal pools that may be hydrologically connected to the river.
- *Ground/soil disturbance from operations and maintenance activities:* Project maintenance may result in temporary or long-term effects on botanical resources as vegetation around project facilities is removed and/or herbicides are used. Wetlands can be affected by operations and maintenance activities that change drainage flows or patterns or that result in physical disturbance.

- *Disturbance from project-related recreation:* Botanical resources may be directly and indirectly affected by project-sponsored recreation. Development and use of recreational facilities causes direct loss of vegetation through physical removal. Vegetation may be indirectly affected by trampling and/or soil disturbance and compaction from trails, roads, and camping. Disturbance also creates conditions suitable for the establishment of non-native or noxious plants. Recreational activities may also spread seeds or plant parts to uninfested areas.

Indirect impacts often result in degradation of plant communities by creating conditions that favor the establishment of non-native or noxious weeds. Noxious weeds can alter plant community structure, reduce species diversity, and /or displace special-status plants or critical habitat for wildlife.

Populations of Threatened, Endangered, Rare, or other special-status plant species may be affected by project facility operations, recreation activities, maintenance activities, and/or facility expansion. Modifications to plant community structure, such as fuels reduction activities and the invasion of noxious weeds, may also affect special-status plant species. Activities that result in the direct loss of a sensitive plant population, alteration of occupied habitat, or conditions that decrease plant viability would constitute an adverse impact, as defined by FESA and CESA.

Riparian vegetation could be affected by daily and seasonal flow variations. Riparian vegetation recruitment may also be affected by the upstream trapping of sediment by Lake Oroville, or may be affected by bank erosion. Alterations of flows could change the area available for riparian plant colonization, or modify riparian assemblages.

Isolated wetland features may appear as ponds, impoundments created by dredger tailings, and vernal pools. These wetland features can be affected by operations and maintenance associated with recreation and the Oroville Facilities, such as changes in drainage flows or patterns and physical removal or disturbance. Alterations of wetlands could be a significant impact.

The analysis of impacts on botanical resources from the primary alternatives will focus on the following specific geographic areas within the study area:

- Upstream tributaries of Lake Oroville, including the West Branch and the North, Middle, and South Forks of the Feather River;
- Lake Oroville;
- The Thermalito Diversion Pool;
- Thermalito Forebay and Thermalito Afterbay;
- The OWA;
- The low-flow channel of the Feather River; and

- The Feather River from the Thermalito Afterbay outflow to the confluence with the Sacramento River.

The analysis of potential impacts on botanical resources will consider:

- Degradation of botanical resources including wetlands, waters of the United States, and special-status species as a result of project-related recreation;
- Potential loss of biodiversity as a result of project-related operations and maintenance (including plant species, seral stages, vegetation types and communities, and wildlife habitats);
- Potential project-related introduction, distribution, and management of non-native and noxious terrestrial and aquatic weeds;
- Significant impacts as a result of existing and future project facilities, operations, and maintenance on upland habitat types, including revegetation and restoration efforts;
- Considerable alteration of plant natural communities as a result of fire prevention/fuel load control;
- Effects of existing and future project operations on downstream riparian zones and floodplains, and reservoir fluctuation zones, including soil stability, natural flood management functions, revegetation of native plant communities, restoration opportunities (e.g., red willow planting), bank swallow habitat, riparian habitat, and vernal pools;
- Potential project-related impacts on federally listed and State-listed Threatened, Endangered, or Rare as well as sensitive species, species of concern, proposed, and special-interest plant species (i.e., plants regarded as ethnographically important by Native Americans);
- Botanical resource measures that may conflict with other resources;
- Compliance with §7 of FESA as well as CESA; and
- Cumulative impacts.

4.9.2 Methods of Analysis

Methods of analysis used to assess potential direct or indirect impacts on botanical resources from the primary alternatives involve reviewing and distilling results from the project studies on vegetation, sensitive plants, and noxious weeds, as well as other relevant studies. Data gaps will be addressed by interviewing researchers or other scientists with relevant knowledge of species, habitats, or dam-related impacts, and reviewing of applicable literature, studies, and other pertinent data.

GIS analyses may be a useful tool in providing a quantitative evaluation of the effects of various PM&E measures and operational scenarios. For example, GIS could be used to estimate the amount of vegetation affected by new recreational developments, as well as proximity to sensitive resources such as populations of sensitive plant species. GIS could also be used to determine the extent of noxious weed populations within the FERC project boundary, as well as the species, and to identify the areas that would benefit most from an action that would control and reduce weeds.

4.10 CULTURAL RESOURCES

4.10.1 Types and Causes of Potential Impacts

The study area contains historical, archaeological, and ethnographic resources that are collectively managed as cultural resources. The primary alternatives, including continued operation of the project under the No Action Alternative, have the potential to affect cultural resources in the study area. Section 106 of the National Historic Preservation Act (NHPA) requires that federal agencies take into account the effects of their actions on properties that are listed on the National Register of Historic Places (NRHP) or may be eligible for listing. The analysis of potential impacts on cultural resources will consider the following factors:

- Erosion, decay, or exposure of cultural resources as a result of fluctuations in reservoir water levels;
- Inundation of resources, causing them to be damaged and/or inaccessible;
- Vandalism, artifact theft, or unintentional damage to cultural resources from off-road vehicle use or other recreational activities;
- Ground disturbance associated with road construction and/or maintenance, removal, and treatment of floating debris, facility construction activities, or wildlife management actions, which may affect the physical integrity of cultural resources by destroying or compromising the potential for research information;
- Effects on a traditional cultural property that cause the cultural significance of that property to be compromised, altered, or destroyed, such as elimination of native plant/wildlife/fish habitat from a location where a community has conducted traditional cultural practices of resource collection;
- Damage or alterations to historic buildings or structures that may affect the architectural integrity that contributes to the NRHP eligibility of these resources; and
- Impacts on cultural resources that could occur indirectly through the alteration of the character of the resource's setting, such as the introduction of visual, audible, or atmospheric elements associated with new land uses that change the

character of a site or its setting in a manner that adversely affects the significant values of the resource.

Under federal regulations implementing §106 of the NHPA (36 CFR §800.5), a project would have an effect on a historic property when the undertaking could alter the characteristics of the property that may qualify the property for inclusion in the NRHP. An undertaking may be considered to have an adverse effect on an historic property when the effect may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

4.10.2 Methods of Analysis

The efforts to identify, evaluate, and manage significant cultural resources under federal laws, regulations, policies, and guidelines are similar in nature. For this project, these efforts are addressed by SP- C1, Cultural Resources Inventory; SP-C2, Cultural Resources Evaluation; and SP-C3, Cultural Resources Management. Information from these studies will be used in the analysis of impacts of the primary alternatives on cultural resources found in the January 2005 PDEA.

To analyze the potential effects of proposed projects on significant cultural resources (known as "historic properties" under the NHPA), the §106 review process involves the following steps:

- Initiate the §106 process by determining that the proposed project is an undertaking that could effect historic properties, developing a plan for public involvement, and identifying other consulting parties.
- Identify historic properties by determining the scope of efforts, establishing the Area of Potential Effects (APE), identifying cultural resources within the APE, and evaluating their eligibility for inclusion in the NRHP.
- Assess adverse effects by applying the criteria of adverse effect to historic properties (36 CFR §800.5).
- Resolve adverse effects by consulting with the State Historic Preservation Officer (SHPO) and other consulting parties, including Native American Tribes and the Advisory Council on Historic Preservation, if necessary, to develop an agreement that addresses the treatment of historic properties.

4.11 GEOLOGY AND GEOMORPHOLOGY

4.11.1 Types and Causes of Potential Impacts

The Oroville Facilities are located in an area of relatively low to moderate seismicity and, as such, the likelihood of strong seismic shaking occurring in the region is low.

Oroville Dam is founded on stable bedrock that would not be subject to ground failure such as liquefaction. Landslides have occurred along the perimeter of Lake Oroville and may increase in the future, if reservoir levels fluctuate more frequently.

Ground-disturbing activities, including construction and maintenance of roads and fuel breaks, ditches, gravel extraction, and site development, could result in soil erosion or loss of topsoil at discrete locations.

Changes in the operation of the Oroville Facilities can alter the Feather River and tributaries both above and downstream of Oroville Dam. The largest Lake Oroville tributaries are the West Branch and the North, Middle, and South Forks of the Feather River. Changes in reservoir water levels may raise the local base level in streams entering the reservoir, and these higher base levels could result in channel configuration changes caused by sediment storage and periodic sediment loading.

Ongoing incremental changes in stream geomorphology have been identified within the Feather River channel. These changes potentially erode farmland and alter instream conditions for fish and other organisms. Flow releases from the Oroville Facilities and blockage of sediments by Oroville Dam may contribute to these changes in channel configuration by altering natural hydrology and sediment transport processes. Changes in streamflows can cause channel widening and deepening and also affect bank erosion. Trapping of fine sediments behind the dam contributes to a coarsening of substrate on the floodplain surfaces and contributes to changes in riffle morphology.

As described above, the primary alternatives have the potential to affect geology and geomorphology in the project area. The analysis of potential impacts on geology and geomorphology will consider:

- The potential effects of seismic, geologic, or soil-related hazards on project facilities;
- The effects of project-induced changes in streamflow on channel morphology in the Feather River downstream of Lake Oroville using FLUVIAL-12 modeling of sediment transport;
- The effects of trapping of coarse sediment behind the dam at Lake Oroville on riffle morphology and substrate in the Feather River below the dam;
- The effects of trapping of fine sediment behind the dam at Lake Oroville on the recruitment of fine sediment to the Feather River floodplain below the dam;
- The cumulative effects of sediment trapping behind the dam at Lake Oroville on the construction of floodplain surfaces in the Feather River below the dam;
- The effects of project-induced changes in streamflow and sediment discharge on bank erosion in the Feather River downstream of Lake Oroville;

- The effects of raising the local base level and reservoir level fluctuations on sedimentation in the Feather River and its tributaries upstream of Lake Oroville;
- The effects of project-induced reservoir level fluctuations on reservoir shoreline erosion and mass wasting;
- The effects of trapping of large woody debris behind the dam at Lake Oroville on the Feather River downstream of the dam;
- The effects of project-induced streamflow changes and channel changes downstream of Lake Oroville on groundwater levels below the dam; and
- The cumulative effects of trapping of sediment and large woody debris behind the dam at Lake Oroville on the ecological conditions in the Sacramento River and the Delta.

4.11.2 Methods of Analysis

4.11.2.1 Geologic, Seismic, and Soils Risk to Facilities

A qualitative analysis will be conducted of the location of the Oroville Facilities relative to known risk factors. Existing data (maps and reports) will be used along with the results of a risk assessment performed by a qualified geologist. The key data sources will be existing geologic studies, soils maps, and maps of facilities, including a study published by DWR in 1978 on the responses to the 1975 Oroville earthquake.

4.11.2.2 Effects on Downstream Channel Geomorphology

Changes in the hydrology of the lower Feather River will be evaluated using the outputs from the Indicators of Hydrologic Alteration modeling conducted as part of SP-G2, Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam. This will provide a quantitative basis for describing changes caused by the creation and operation of Lake Oroville. The methods of analysis for changes in channel morphology will include use of data and interpretations generated from SP-G2 to summarize changes in the planform, cross section, and geomorphic surfaces of the Feather River downstream of Lake Oroville. In addition to field data, valuable sources of information will include historical studies of riffle substrate composition, and outputs from FLUVIAL-12, which is capable of modeling geomorphic changes in the low-flow channel. This analysis will be quantitative and will indicate rates of channel incision and widening, amount of bank erosion, and changes in riffle substrate over time.

It will not be possible to quantitatively evaluate how the relative proportions of instream habitat types (pools, riffles, etc.) in the Feather River have changed since creation of Lake Oroville, because there are no pre-dam data available. Consequently, this analysis will be qualitative and will focus on gross changes that have been caused by channel widening and incision.

It will not be possible to quantitatively analyze changes in deposition of fine sediments on Feather River floodplains. It is assumed that rates of accretion have been reduced because of changes in peak flows and trapping of sediment by Lake Oroville. Therefore, this analysis will be qualitative and, to some degree, based on professional judgment.

4.11.2.3 Effects on Upstream Channel Geomorphology

SP-G2 will provide data on the effects of reservoir level fluctuations on sediment deposition in and near upstream tributaries. The size, composition, and duration of such deposits will be quantified. The implications for fish passage and reservoir capacity can be inferred from these data and utilized by other resource area specialists.

4.11.2.4 Effects on Reservoir Shoreline

All areas of erosion and mass wasting have been mapped in SP-G2. These maps will provide the basis for quantifying the amount of soil loss. Landslides at the reservoir perimeter have also been mapped and age-dated (ancient to recently active). The amount of reservoir perimeter in contact with landslides is known (75,000 linear feet). The implications for future erosion and landslides can be evaluated qualitatively using this information.

It probably will not be possible to quantitatively evaluate changes in reservoir storage caused by shoreline erosion and mass wasting. Therefore, this will be addressed qualitatively in terms of expected changes in reservoir service life.

4.11.2.5 Large Woody Debris in the Lower Feather River

SP-G2, Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam, provides a mapping and piece count for all large woody debris presently found in the Feather River below Lake Oroville. No data are available for pre-dam conditions. Data also exist on the area of wood captured by the reservoir. The analysis of the historical and present geomorphic and ecological functions of wood in the system can only be evaluated qualitatively. It is possible that fisheries habitat studies will provide at least some quantitative data on selection of wood-influenced habitats by fish.

4.11.2.6 Groundwater Data

There are anecdotal data for conducting a qualitative analysis of groundwater changes below Lake Oroville. It is assumed that groundwater levels in the vicinity of the Thermalito Complex have increased, but the degree of impact is unknown. Additional information may be forthcoming from water quality studies. The low-flow channel has limited potential for groundwater effects because of the nature of the channel. For the lower Feather River, it is assumed that groundwater levels have declined as the channel has incised over time.

4.12 LAND USE, MANAGEMENT, AND PLANNING

4.12.1 Types and Causes of Potential Impacts

The primary alternatives have the potential to conflict with or be inconsistent with current and future nearby land uses and land management direction (as indicated in local, State, or federal land use and management plans).

The analysis of potential impacts on land use, management, and planning will consider:

- The potential for conflict with local, State, or federal government land use and management plans;
- Direct land use impacts, such as the potential displacement of existing residents or businesses; and
- Direct impacts on adjacent land uses, such as placing incompatible land uses together.

4.12.2 Methods of Analysis

The methodology used to evaluate potential land use impacts will consider baseline information that will be summarized from SP-L1, Land Use, and SP-L2, Land Management. It will also draw on the discussion of ongoing land use effects that are referenced in these two study reports to evaluate potential impacts, namely land use incompatibility issues, associated with the No Action Alternative.

As for the primary action alternatives, detailed information on proposed changes to existing facilities and operations or the development of new facilities will be collected and reviewed against the baseline conditions identified in the study reports. This information will include the physical location, size, and operating criteria of facilities, which will allow these facilities to be mapped on the land use and land ownership maps that delineate existing land use/ownership boundaries within and adjacent to the FERC boundary. Based on the mapping, characteristics of proposals, and field-level reconnaissance, potential land use incompatibilities will be identified and analyzed in the context of common land use compatibility issues (e.g., public health/safety, noise). The mapping and field-level efforts will also allow the determination of whether land uses would be precluded in certain areas or whether there would be any disruptive effects on existing homes, businesses, or the configuration of the community.

In addition, the analysis will include a review of the primary alternatives in the context of established local, State, or federal land use and management plans to determine whether the alternatives are consistent with such plans. This plan consistency analysis in Section 4.12 will only focus on land use and management–related plans, and will not address resource-based plans (e.g., habitat conservation plans, natural community conservation plans); the consistency of such plans will be evaluated in detail in Chapter 9.0, Consistency with Comprehensive Plans. All plan consistency analyses will be based on information acquired as part of SP-L3, Comprehensive Plan Consistency.

Other land use and management–related studies will also be consulted, including SP-L4, Aesthetics; SP-L5, Fuel Load Management; and SP-R4, Assess Relationship of Fish & Wildlife Management and Recreation, to help assess the effects of the alternatives on land use, land management, and planning.

4.13 MINERAL RESOURCES

4.13.1 Types and Causes of Potential Impacts

The primary alternatives will be evaluated for potential impacts on mineral resources. The analysis may consider:

- Effects on active gravel mining operations in the study area;
- Effects on mining claims in the study area;
- Effects on oil, gas, and geothermal wells in the study area;
- Mining, oil, gas, or geothermal well operations that may be affected or conflict with proposed land uses or new facilities;
- The potential for conflicts with mining area expansion plans;
- The potential for loss of availability of a known mineral resource that would be of value to the region or state; and
- The potential for loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

4.13.2 Methods of Analysis

The methods that will be used to conduct this analysis may include:

- Researching locations of active mines, mining claims, and oil, gas, and geothermal well operations;
- Consulting with mine owners to discuss potential conflicts with current operations or mine expansion plans;
- Incorporating information on third-party leases for aggregate mining operations (gravel extraction) that will be contained in Study Report L2;

- Consulting with the California Geological Survey (formerly known as the California Department of Mines and Geology);
- Consulting with federal land management agencies regarding mineral extraction and mining claims on public lands in the study area; and
- Consulting with Butte County to identify important mineral resources identified in the General Plan or other land use plan.

4.14 NOISE

4.14.1 Types and Causes of Potential Impacts

The primary action alternatives have the potential to affect noise levels in the study area. Noise impacts could be caused by vehicles and construction equipment used in creation of new recreation facilities, new or maintenance clearing of vegetation at existing fuel breaks, grading on access roadways and parking areas, or construction of additional access and parking for existing facilities.

Along with these potential construction activities, recreationists at new recreation facilities located near sensitive receptors (including residences, hospitals, schools, or commercial establishments) may cause adverse impacts.

The analysis of potential noise impacts will consider:

- Construction activities, which may result in temporary noise levels that exceed desirable conditions for occupied campgrounds, picnic grounds, and marinas;
- Activities by recreationists at new recreation facilities located near sensitive receptors; and
- The fact that, in general, increased recreation at existing facilities can result in increased noise levels

4.14.2 Methods of Analysis

To assess potential short-term (i.e., construction) noise impacts, sensitive receptors and their relative exposure (considering topographic barriers and distance) will be identified. Noise levels typically associated with the various construction activities will be calculated based on typical noise levels obtained from the USEPA. Predicted noise levels at nearby receptors will be calculated assuming an average noise attenuation rate of 6 A-weighted decibels (dBA) per doubling of distance from the source and taking into account intervening barriers and topography.

Potential long-term noise impacts would be associated primarily with increased visitation and recreational use opportunities (i.e., increased on-highway vehicle volumes and watercraft activities), as well as the relocation of some existing recreational use areas and vehicle access routes. The assessment of long-term noise impacts will be based on noise data obtained from similar activities, as well as recreational use data obtained for Butte County and noise level emissions data obtained from USEPA and the Federal Highway Administration. Resultant noise levels at nearby noise-sensitive land uses will be predicted based on standard attenuation rates typically applied to stationary and line sources and taking into account intervening barriers and terrain. Resultant effects on wildlife are qualitatively discussed in Section 4.23, Wildlife Resources.

4.15 PALEONTOLOGICAL RESOURCES

4.15.1 Types and Causes of Potential Impacts

Paleontological resources (fossils) provide evidence of once-living organisms that have been preserved in geologic sediments. The study area contains a variety of paleontological resources and unique geological formations. The primary alternatives have the potential to affect these resources and formations. The analysis of potential impacts on paleontological resources will consider:

- Inundation of fossils and fossil-bearing geologic formations, which could cause them to be inaccessible for scientific study and collection;
- Wetting and drying cycles associated with reservoir operation, which could result in exposure of new rock surfaces, or could cause geologic outcrops and fossils to be covered with algae and silt, thus obscuring them from view;
- Wave erosion, which could result in exposure of highly indurated (hardened) rock strata previously obscured by softer sediments;
- Reservoir releases, which could induce currents in relatively narrow channels, resulting in loss of fossils from exposed geologic strata;
- Potential degradation of exposed fossils, even those in hard bedrock—a particularly acute effect in less indurated sediments;
- Potential increased access by boaters and by other visitors as a result of construction of access roads, which could contribute to vandalism, unauthorized amateur or commercial collecting, or unintentional damage by off-highway vehicles, recreationists, and other visitors; and
- Ground disturbance associated with road construction and maintenance, facility construction activities, or wildlife management actions, which could result in direct destruction of fossils.

4.15.2 Methods of Analysis

Information presented in this section will be derived primarily from Paleontological Resources in the Vicinity of FERC Project 2100 [Oroville Reservoir and Lower Feather River]: Literature-based Inventory and Significance Assessment (Hanson 2003). As the study title indicates, this is a primarily literature-based inventory prepared for the Oroville Facilities Relicensing project. The presence of fossils and fossil-bearing geological formations within the study area was assessed in this study through professional examination of published and unpublished literature, examination of museum collections and associated records of fossil finds, and interviews with persons familiar with the geology and paleontology of the study area.

The resulting study documents known locations of fossils within the study area. It also documents geological formations that have produced fossils elsewhere, but for which there have not yet been any documented fossil finds within the project area. The study (Hanson 2003) points out that no systematic field inventory has been conducted for the project area. Such an inventory is recommended for assessment of specific impacts.

General potential impacts will be assessed on the basis of potential impact areas (identified on the basis of erosion modeling, areas with other sorts of project operational impacts, and plans for recreational development) and general sensitivity areas in terms of potentially fossiliferous geological formations. A field inventory could be undertaken as a partial mitigation measure. Final mitigation will appropriately consist of a plan to either protect significant fossils in place, or salvage those fossils for which protection measures are unlikely to be effective. Mitigation will be completed on a case-by-case basis as projects are implemented.

4.16 PUBLIC SERVICES

4.16.1 Types and Causes of Potential Impacts

The following summarizes the types and causes of potential impacts to public services associated with implementation of the primary alternatives:

- Implementation of PM&E measures could increase the risk of fires as more recreationists visit the study area, or decrease such risks if new vegetation management measures are implemented and reduce fuel loads.
- An increase in recreation use may increase the need for law enforcement and search and rescue services. Several scoping comments noted concerns over insufficient law enforcement in the OWA under existing conditions; this situation could be aggravated if PM&E measures lead to an increase in recreation use in OWA.

4.16.2 Methods of Analysis

The assessment of public service effects associated with the primary alternatives consists of the following discrete tasks. Relicensing SP-R12, Projected Recreation Use, will estimate future recreation use within the study area based on a variety of factors including projected demographic changes and the effects of reservoir pool levels on visitation. Estimates of projected recreation use at the Oroville Facilities will be used to determine whether there would be a significant increase in the frequency of wildfires, which would create a demand for fire-fighting services; this analysis will be based in part on information from SP-L5, Fuel Load Management Evaluation. Similarly, increased recreation use may result in the need for other additional public safety resources as well, including law enforcement and search and rescue; this analysis will be based in part on SP-R2, Recreation Safety Assessment. The agencies most likely to be affected by changes in demands on public services are the CDF, DPR, and DFG, given their primary roles related to public safety and firefighting. SP-R19, Fiscal Impacts, will also inform this analysis.

4.17 PUBLIC HEALTH AND SAFETY

4.17.1 Types and Causes of Potential Impacts

The primary alternatives have the potential to affect public health and safety in a number of ways. The major study topics included in the public health and safety resource area are public health–related water quality impacts related to waterborne diseases, bioaccumulation of contaminants, and toxic substances; vectors (principally mosquitoes); hazardous materials and waste; wildfires, particularly at the urban/wildland interface; and flooding, landslide, and seismic–related hazards as they relate to public health effects. The analysis of potential impacts on public health and safety will consider the following factors:

- Elevated concentrations of disease-causing bacteria and other pathogens downstream of Oroville Dam in the low-flow channel associated with decomposing salmon, particularly during periods of high mortality in the spawning salmon;
- Potential discharge of wastewater by septic systems at new or existing (project or project-related) facilities, which could release fecal coliform bacteria;
- Elevated levels of fecal coliform bacteria from recreationists (e.g., humans, dogs, horses) or related activities and/or from waterfowl;
- Elevated levels of fecal coliform bacteria, nutrients, turbidity, metals, solvents, MTBE, oil and grease, and other petroleum byproducts from construction-related activities (e.g., spills, overfilling, discharges), or accidental spills at marinas and other recreation areas;

- Accumulation in animal and fish tissues of methyl mercury, PCBs, polybrominated diphenyl ether (PBDE), and other metal and organic contaminants from water and sediments at the bottom of Lake Oroville, Thermalito Forebay and Thermalito Afterbay, elsewhere at the Oroville Facilities, and in the lower Feather River;
- Changes in water releases and streamflows, with the potential to increase or decrease the amount of breeding habitat available to mosquitoes (an increase in the number of mosquitoes has been recently reported in the OWA, and overgrown vegetation prevents effective mosquito abatement activities);
- An change in the frequency of flooding or flood stage elevations resulting from implementation of PM&E measures;
- Decreased stability of levees or the capacity of stream channels to handle high flows resulting from construction or maintenance activities;
- Risk of potential penstock rupture;
- Removal and disposal of contaminated and hazardous waste sites;
- Transport, use, and disposal of hazardous materials;
- Exposure of people or structures to risk of wildland fires; and
- Seasonal fluctuations of Lake Oroville, which could potentially increase seismic activity in the area, which in turn—when combined with antecedent rainfall—could potentially result in the reactivation of several identified landslides around the reservoir (potential for flooding, dam failure, etc.).

4.17.2 Methods of Analysis

The methodology used to evaluate potential public health and safety impacts resulting from the primary alternatives will vary depending on the type of impact evaluated. Below is a description of the various methodologies that will be used in the analysis.

4.17.2.1 Water Quality

Water quality studies currently under way as part of the relicensing effort will be reviewed and appropriate information will be evaluated concerning potential impacts on public health and safety from constituents of concern identified in project waters (including Lake Oroville, the Thermalito Complex, OWA, and the lower Feather River). These studies include SP-W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Waters; SP-W3, Recreational Facilities and Operations Effects on Water Quality; and SP-W7, Land and Watershed Management. The comprehensive list of water quality limits for constituents and parameters will form the basis of the analysis of impacts of the primary alternatives on public health.

4.17.2.2 Contaminant Accumulation

Related to the water quality methodology described above, contaminant accumulation in fish, sediment, and the aquatic food chain can ultimately adversely affect human health or the environment. Potential impacts on human health and the environment from bioaccumulation of inorganic and organic constituents will be analyzed using data developed in the following study plans: SP-W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Waters; and SP-W2, Contaminant Accumulation in Fish, Sediments, and the Aquatic Food Chain. The specific thresholds of significance (or criterion) for potential contaminants of bioaccumulation concern, particularly mercury (specifically methyl mercury) which has been identified as a potential problem in the aquatic food chain in the project area, will be compared to the data collected from the water quality and bioaccumulation study plans to determine potential adverse public health effects associated with the primary alternatives.

4.17.2.3 Mosquitoes

There are significant amounts of standing water areas within the Oroville Facilities project area that are potential breeding grounds for mosquitoes. With the recent reported introduction of West Nile virus into California, the potential impact on public health and safety from mosquito vectors in the study area has taken on a new significance.

There is no project study plan that directly addresses the mosquito vector control issue in the study area. However, an analysis of potential significant impacts on public health and safety could be conducted based on other sources of available information such as the location of water sources suitable as potential mosquito habitat and information obtainable from DFG, the Butte County Mosquito and Vector Control District, the Butte County (County) Department of Public Health, and the California Department of Health Services (DHS) and its Vectorborne Disease Surveillance System.

Mosquito control methodologies must also be looked at in relation to their potential adverse effect on public health and safety, particularly if pesticides are used for mosquito control.

4.17.2.4 Flooding

Flood control, for the purposes of maintaining public health and safety, is an integral part of Oroville Facilities operations and one of the principal beneficial uses of the Oroville Facilities.

4.17.2.5 Stability of Levees, Penstock Rupture, and Dam Failure

Information involving the discussion of potential impacts on public health and safety from decreasing stability of levees, potential penstock rupture, or dam failure will be derived principally from the latest FERC Part 12 Safety Inspection Report, which was prepared by an independent consultant.

4.17.2.6 Landslide/Dam Overtopping

On August 1, 1975, an earthquake of magnitude 5.7 occurred approximately 7 miles south of Lake Oroville. The earthquake, and accompanying foreshocks and aftershocks, caused surface faulting along the northwest trending Foothills fault system. In addition, 3 other earthquakes of magnitude 5.0–5.9 have occurred since 1900 near the Foothills fault system (within 40 miles of Oroville). DWR studies subsequent to the 1975 earthquake did not confirm whether the operation of the Oroville Facilities contributed to the seismic activity, but such cause-effect relationships have been identified in other reservoirs.

DWR has mapped several landslides in the immediate areas surrounding Lake Oroville, including a large landslide north of Bloomer Hill. Therefore, during an unlikely event that entails antecedent rainfall, heavy winds, and a moderate to significant seismic event in the area, there could be the potential for reactivating slide planes. Such a reactivation could result in mass movements of soil and rock into the reservoir, causing a seiche (seismically induced wave) to overtop Oroville Dam.

4.17.2.7 Hazardous Materials and Wastes

Within the study area, there may be existing hazardous waste sites that could adversely affect public health and safety. Such sites should be identified, where possible, within the study area boundaries. One accepted method is to have a computerized database search conducted for the study area. There are numerous commercial services in the United States that will conduct such database searches for a nominal fee. This database search can then be augmented with review of files and discussions with the staff at the County Department of Environmental Health, the California Department of Toxic Substances Control (DTSC), and USEPA.

Continued operations of the Oroville Facilities will necessitate the transport, use, storage, and disposal of hazardous materials, such as petroleum and cleaning products. Accidental release and/or improper handling of hazardous materials can affect public health and safety. Hazardous materials used and stored within the study area could be determined by review of hazardous materials management plans (HMMPs) maintained by DWR and other entities that use and store hazardous materials within the boundaries of the study area. Under California law, if hazardous materials in amounts exceeding certain thresholds are used and stored at a site, there must be an HMMP at the site and generally copies must be given to local agencies that might conduct emergency response activities. In addition, facilities within the study area that need to legally dispose of spent hazardous materials that become a hazardous waste must ship such waste via the Uniform Waste Manifest system. Thus, there is generally a sufficient record, through either HMMPs or waste manifests, to ascertain the type and amount of hazardous materials entering and leaving the study area. This knowledge can then be used to determine any potentially significant effects on public health and safety.

4.17.2.8 Wildfires

There is a stakeholder concern that historic fuel management and fire prevention and suppression activities have increased biomass fuel loads in the study area. An increased fuel load can lead to an increased risk of destructive wildfires and their concomitant impacts on public health and safety, which is manifested in the potential loss of property and structures, injury, and even death.

To address this potential significant impact on public health and safety, information gathered and presented for SP-L5, Fuel Load Management, will be used. An interim report has been prepared to address the study plan needs. In that report are maps and figures that display the fuel hazard ranking and fuel load conditions throughout the study area. Of particular concern is the area of urban-wildland interface where the potential for significant impacts on public health and safety may be highest. This potential will be analyzed and discussion (with graphics) will be prepared to address those areas where public health and safety concerns from potential wildfire are highest.

4.17.2.9 Other Topics

The following study topics have not been fully evaluated by the study plans:

- Updated seismic analysis with respect to changes in California's probabilistic seismic hazards for the study area; and

Evaluation/update of the potential response of the Oroville Facilities with relation to seismic activity in the vicinity of Oroville.

4.18 RECREATION

4.18.1 Types and Causes of Potential Impacts

The primary alternatives have the potential to affect recreation in the project area. The analysis of potential impacts on recreation will consider the potential for:

- Construction of in-river weirs or fish passage structures;
- Fluctuations in reservoir water levels;
- Changes in flows in rivers during the recreation season;

- Changes in river temperature that would affect recreational swimming, tubing, canoeing, kayaking, and rafting;
- Temporary restriction of recreation activities as a result of construction;
- Conversion of recreation facilities to other uses;
- Changes in aesthetic conditions that could affect visitor appreciation of an area and the quality of recreation experiences;
- Reduction of opportunities related to one activity, resulting in an increase in visitor days for other recreational uses (shifting activities);
- Changes in fishing or hunting opportunities;
- Changes in accessibility to recreation sites;
- Inadequacy of existing project recreation facilities, opportunities, and access to accommodate current use and future demand;
- Changes in the level of public safety at Oroville Facilities recreation sites;
- Effects of facility operations on recreation opportunities;
- Adequacy of operations and maintenance and clean-up activities associated with existing and new recreation areas to provide a quality recreational experience;
- Shifts in the recreation funding, development, and management structure;
- Appropriate management of fisheries and wildlife resources to provide recreation opportunities;
- Effects of the project on Land and Water Conservation Fund properties (see Public Law 92-347, July 11, 1972); and
- Conflicts between competing uses and alternatives considered (such as flows to increase fishery habitat versus flows for whitewater boating).

4.18.2 Methods of Analysis

The assessment of recreation impacts associated with the project requires all of the following:

- An inventory and assessment of current local and regional recreation use and conditions;
- An assessment of opportunities and constraints related to recreation facilities and activities;
- An assessment of current management of recreation areas; and
- Projections of demand for recreational use of the project into the future.

To meet this wide range of needs, the Recreation and Socioeconomics Work Group developed 17 study plans to guide 17 separate recreation studies. Two additional study plans were developed to guide Socioeconomics studies; these are discussed in Section 4.19 of this document.

The 17 recreation studies are interrelated; several rely in part on data collected in other studies to meet their objectives. For example, the several surveys of current and potential recreational visitors to the project area conducted for SP-R13, Recreation Surveys, provided information for six other recreation studies. In addition, studies of water and terrestrial resources conducted under the direction of the Environmental Work Group provided information used in several recreation studies. Conversely, assessment of impacts on these resources will rely in part on data provided by recreation studies.

Provided below is a general description of each of the 17 studies and their contribution to the assessment of recreation impacts, organized by general purpose of the studies.

4.18.2.1 Inventory Studies

SP-R1, Vehicular Access Study, evaluated the adequacy of public access to project facilities and waters, with the focus on roads that lead to existing or potential recreation sites. SP-R6, ADA Accessibility Assessment, evaluated the extent to which existing recreation facilities meet requirements for accessibility for persons with disabilities. SP-R10, Recreation Facility Inventory and Condition Report, provides a detailed description of the existing recreation facilities at the project and identifies condition and maintenance issues.

Study SP-R9, Existing Recreation Use, provides detailed estimates of the total current use of the project area for recreation as well as estimates of use of individual recreation sites and participation in specific recreation activities. Study SP-R13, Recreation Surveys, used a series of surveys to obtain information on current recreation visitors and their use of the project area, and their perceptions related to a range of recreation issues. The surveys were also used to contact visitors at other reservoirs and other residents of the region to learn their perceptions of the project area.

Two studies were focused on assessment of two specific recreation issues of importance: public safety and ecological impacts of recreation. SP-R2, Recreation Safety Assessment, identified safety issues and concerns within the project area. SP-R11, Recreation and Public Use Impact Assessment, qualitatively assessed recreation and public use impacts on vegetation, soils, and water quality at recreation sites and dispersed use areas.

Because boating is the most predominant activity in the project area, and is associated with other important activities such angling and swimming, two studies are focused on assessing two types of boating. SP-R7, Reservoir Boating, documented the amount and character of boating activity occurring on Lake Oroville and the other project reservoirs. In addition, the condition and adequacy of developed boating facilities, boating safety issues, and boaters' perceptions of conditions were assessed. All of this information was used to assess the current capacity status of the reservoirs for boating. SP-R16, Whitewater and River Boating, evaluated an intermittent whitewater run available during some low-water years on the North Fork Feather River arm of Lake Oroville (with primary access outside of the Oroville Facilities FERC boundary), and boating conditions on the Feather River below Lake Oroville.

4.18.2.2 Opportunities and Constraints Studies

Identification of opportunities and constraints related to recreation was accomplished by three studies. SP-R3, Assessment of the Relationship of Project Operation and Recreation, evaluated the effects of the annual drawdown and low-water conditions on boating facilities and activity. Also evaluated were the effects of pool level fluctuation and temperature on boating, swimming, and other activities in the project reservoirs downstream of Lake Oroville and the effects of Feather River flows and temperatures on boating, swimming, and angling. SP-R15, Recreation Suitability, evaluated the suitability of lands within the project area for development of new or expanded recreation facilities based on environmental, land use, and cultural resource constraints. SP-R8, Carrying Capacity, evaluated the capacity of existing facilities to support recreation use and documented constraints on recreation use related to capacity limits.

4.18.2.3 Recreation Management Studies

Two studies assessed two aspects of recreation management. SP-R5, Recreation Area Management, assesses overall recreation management within the project area, and explores any opportunities for improvements in coordinated management among the several managing agencies with responsibilities within the project area. SP-R4, Fish and Wildlife Management and Recreation, assesses the effects of fish and wildlife management on recreation opportunities within the study area. The DFG has principal jurisdiction over fish and wildlife resources and DFG management was one focus of this study.

4.18.2.4 Recreation Demand Studies

SP-R12 supplies projections of recreation demand through the period of the anticipated new license. SP-R14 provides additional information to assess likely demand by evaluating the regional supply of recreation opportunities and barriers that may exist to recreational use of the project area for regional residents.

4.18.2.5 Recreation Needs Analysis

SP-R17, Recreation Needs, is the capstone recreation study related to the Oroville Facilities Relicensing. The study integrates the recreation inventory, demand, management, and opportunity and constraint information obtained through all of the other recreation studies to develop conclusions about any needs for additional or enhanced recreation facilities to serve specific types of recreation activity needs. Needs are addressed throughout the anticipated term of the new license, as required by FERC guidelines.

4.18.2.6 Non-Recreation Studies used in Impact Assessment

SP-L4, Aesthetics, conducted under the direction of the Land Use Work Group, evaluates the aesthetic conditions and values of the project area, including effects on scenic qualities related to reservoir drawdown.

Several studies conducted under the direction of the Environmental Work Group provided data to the above recreation studies, and thus contributed to the impact assessment. In particular, SP-W3, Recreational Facilities and Operations Effects on Water Quality, and SP-T9, Recreation and Wildlife, were important in documenting water quality and wildlife impacts that could be attributed to recreational use of the area. More detail on these and other studies are provided under the appropriate resource area within this document.

4.18.2.7 Related Study Plans

The following study plans are pertinent to the analysis of project effects related to recreation:

- SP-L4, Aesthetics;
- SP-R1, Public and Private Vehicular Access;
- SP-R2, Recreation Safety Assessment;
- SP-R3, Assess Relationship of Project Operations and Recreation;
- SP-R4, Assess Relationship of Fish/Wildlife Management and Recreation;
- SP-R5, Assess Recreation Areas Management;
- SP-R6, ADA Accessibility Assessment;
- SP-R7, Reservoir Boating Survey;
- SP-R8, Carrying Capacity Study;
- SP-R9, Existing Recreation Use Study;
- SP-R10, Recreation Facility and Condition Inventory;

- SP-R11, Recreation and Public Use Impact Assessment;
- SP-R12, Projected Recreation Use;
- SP-R13, Recreation Surveys;
- SP-R14, Assess Regional Recreation and Barriers to Recreation;
- SP-R15, Recreation Suitability Study;
- SP-R16, Whitewater and River Boating;
- SP-R17, Recreation Needs Analysis;
- SP-R18, Recreation Activity, Spending, and Associated Economic Impacts;
- SP-R19, Fiscal Impacts;
- SP-L2, Land Management;
- SP-W6, Project Effects on Temperature Regime; and
- SP-E1.6, Feather River Flow-Stage Model Development.

4.19 SOCIOECONOMICS

4.19.1 Types and Causes of Potential Impacts

A wide range of activities related to the primary alternatives have the potential to result in socioeconomic impacts. Within Butte County, changes in operation or availability of recreation facilities or opportunities, or changes in reservoir levels or Feather River flows, could result in changes in visitation and spending by recreationists in local communities, which in turn could affect local economic and fiscal conditions. Similarly, changes in operation and maintenance of the Oroville Facilities could cause changes in spending by DWR in local communities, thus also affecting the local economy. Project-related activities also include ongoing positive and negative effects; some of the PM&E measures under consideration may lead to changes in the generation of hydroelectricity or available power capacity, changes in the availability of water supplies, or changes in DWR system water rates (which are influenced by changes in power generation and costs). Potential new construction or habitat improvements related to PM&E measures could generate economic activity and result in local and regional economic effects. Other activities that may cause socioeconomic impacts include changes in agricultural production associated primarily with potential temperature effects and changes in the frequency and magnitude of potential flood events. The activities described above have the potential to cause local and regional direct or indirect impacts on:

- Businesses in Butte County that supply goods and services to Lake Oroville recreationists and to DWR for operations, maintenance, and construction of facilities (including potential increased economic benefits—see Chapter 6.0, Developmental and Economic Analysis);

- Employment (including tribal employment) and income levels in Butte County;
- Population and housing in Butte County;
- Public agency expenditures in Butte County for providing law enforcement, fire protection, and road maintenance services to Oroville recreationists;
- Public agency revenues in Butte County generated by changes in sales, lodging, and property tax bases; and
- Population, employment, and income levels in areas of California (including Butte County) that are dependent on power generated by and water supplies originating from the Oroville Facilities.

Under NEPA, economic and social effects are considered part of the “human environment” and must be discussed if they are interrelated with the project’s natural or physical environmental effects. NEPA documents also need to address environmental justice issues pursuant to federal Executive Order 12898 and the associated USEPA guidelines, which direct federal agencies to examine the potential for a proposed action to have adverse effects that would occur disproportionately in minority and/or low-income communities. The primary alternatives could result in adverse environmental or socioeconomic effects on minority or low-income populations residing near the Oroville Facilities or on populations using the Oroville Facilities. In addition, changes in water or power rates could adversely and disproportionately affect minority or low-income populations throughout California (see discussion of analysis of environmental justice–related effects below).

4.19.2 Methods of Analysis

The assessment of socioeconomic effects associated with the project consists of several discrete tasks. First, the assessment of recreation-related spending patterns will be developed as part of SP-R18, Recreation Activity, Spending, and Associated Economic Impacts, which is based on spending data collected as part of SP-R13, Recreation Surveys. These data were used to develop recreation spending profiles for both local and nonlocal visitors. These spending profiles will be applied to current visitation estimates (SP-R9, Existing Recreation Use) and future estimates of demand (SP-R12, Projected Recreation Use) to determine changes in local and regional spending under current and future with-project conditions. Second, data on the quantity and location of current (fiscal year 2001-02) and future estimates of State expenditures for O&M of the Oroville Facilities will be collected from the primary agencies responsible for these activities (i.e., DWR, DFG, and DBW).

Using the recreation expenditure and O&M data, socioeconomic effects will be estimated using community-level economic impact models constructed as part of SP-R18, which are based, in part, on the IMPLAN economic input-output modeling system. These models were used to generate estimated direct and total sales, employment (number of jobs), and personal income levels within the four modeling areas (i.e., Oroville, Paradise, Biggs-Gridley, and Chico) that comprise Butte County. Next, population effects will be estimated based on the ratio of population to employment in the IMPLAN database for each community-level model.

In addition to local economic effects, fiscal effects will be evaluated for the following jurisdictions: Biggs, Chico, Gridley, Paradise, Oroville, and Butte County. Using a fiscal spreadsheet model that links to the community-level economic impact models, effects on revenues and costs for these jurisdictions generated by changes in recreation-related visitation, recreation-related spending, agency spending, and population changes will be assessed. The fiscal model translates estimated changes in visitation, spending, and population into changes in revenues and public services costs for each jurisdiction.

Using the results of the water use and hydrology and power studies, estimates of impacts to DWR system water rates will be prepared for each primary alternative that would be expected to change the amount of hydroelectricity generated by project facilities, or water supplies delivered by the project. The indirect socioeconomic effects of such rate changes on DWR water customers also will be assessed, focusing on the type of water customers who typically can least afford increases in rates (minority or low-income populations and businesses that use an unusually large amount of water during their operations).

Other potential environmental justice–related effects to be assessed are related to the area directly affected by the use and operation of the Oroville Facilities (i.e., Butte County). These include:

- Identifying populations potentially affected by the adverse impacts of the project;
- Determining whether minority or low-income populations exist within the adversely affected populations; and
- Determining whether the adverse impacts of the project would fall disproportionately on the identified minority or low-income populations.

The environmental justice analysis will be included as part of the social environment analysis and also will consider the potential for minority or low-income populations to experience adverse and disproportionate environmental effects, including adverse air quality, noise or public health and safety impacts. Other elements of the social analysis will address the potential for implementation of PM&E measures and related changes in operations and recreation use to affect social groups and communities, including potential conflicts between recreationists and such other groups as local residents and farmers.

Finally, the socioeconomics analysis will address potential economic effects related to changes in agricultural productivity (based on the results of the agricultural resources analysis; see Section 4.6). These impacts could be caused by temperature-related changes in agricultural productivity and/or loss of farmland caused by the potential construction of new recreation facilities or other improvements that may be included in the primary action alternatives. This analysis will be based on potential changes in average crop yields or quantity of land available for agricultural uses in conjunction with existing data on historic crop prices to determine the effect on gross revenues of agricultural producers. This information will then be used to qualitatively evaluate indirect effects on income, employment, and other related socioeconomic impact topics.

Additional information regarding socioeconomic effects of the primary action alternatives will be provided in Chapter 6.0, Developmental and Economic Analysis.

4.20 TRANSPORTATION AND TRAFFIC

4.20.1 Types and Causes of Potential Impacts

Continued operation and maintenance of the Oroville Facilities under the No Action Alternative and/or implementation of PM&E measures under the primary action alternatives could cause a number of traffic-related impacts, as listed below.

- Current parking, congestion, and access problems could be aggravated or improved, depending on which new recreation facilities, access plans, or other PM&E measures are implemented.
- Recreation-related traffic could increase as a result of an increase in recreation opportunities; air and water traffic as well as surface traffic could be affected.
- Construction-related traffic could increase, including trucks and equipment during construction of new recreation facilities, wildlife habitat improvements, or other projects deemed necessary for the Oroville Facilities.
- There could be potential traffic hazards as a result of the presence of construction trucks or heavy equipment on, or adjacent to, access roadways.
- The need for parking could increase as a result of current deficiencies and/or anticipated increases in visitation to PM&E-related recreation facilities.
- The need for parking during construction could increase to accommodate construction workers and their vehicles, or to park construction equipment.
- There could be a need to provide access to watercraft during emergencies at marinas.

4.20.2 Methods of Analysis

Implementation of the primary alternatives is anticipated to produce two distinct types of effects within the local and regional study area: direct effects related to construction activities or changes in Oroville Facilities operations, and indirect effects related to changes in hydrologic conditions.

The methods of analysis used to evaluate potential effects on transportation and traffic will utilize both quantitative and qualitative assessment techniques. The assessment will begin by describing ongoing effects and other aspects of the affected environment related to transportation and traffic that could be influenced by implementation of the primary alternatives.

To evaluate potential impacts of existing and future project operations on transportation and traffic, the traffic, safety, and future recreation use information developed as part of SP-R1, Public and Private Vehicular Access, SP-R2, Recreation Safety Assessment, SP-R8, Carrying Capacity, and SP-R12, Projected Recreation Use, will be used to determine changes in traffic circulation and levels of service, emergency access, parking, and traffic hazards associated with the Oroville Facilities under alternative operational scenarios. The data developed as part of these study plans will be used to evaluate traffic and transportation impacts under the baseline condition and with implementation of the primary alternatives.

Potential impacts on traffic resulting from changes in proposed recreation activities, facilities, and visitation associated with implementation of the primary action alternatives will be addressed. Estimates of future recreation use at the Oroville Facilities will be estimated as part of SP-R12; this information will form the basis for estimating the quantity of future trips to the Oroville area. The opportunities and constraints information, recreation use information, road conditions, and planned future road projects presented in SP-R1, as well as the traffic LOS data presented in SP-R8, will also be used to assess traffic impacts. These results will be compared to suitable traffic standards to evaluate potential project-related effects. Changes in traffic from the baseline condition resulting from implementation of the primary alternatives will be evaluated to assess each alternative’s contribution to roadway congestion and the resulting potential impacts on traffic circulation.

Potential traffic hazards resulting from proposed construction activities or from project operations will be determined for each of the primary action alternatives. Potential traffic hazards will be qualitatively evaluated based on results from SP-R2, Recreation Safety Assessment.

Potential disruptions or restrictions on emergency access routes in the project area resulting from project construction and/or operation will be determined for each of the primary action alternatives. Effects on emergency access will be qualitatively evaluated based on the traffic constraints information and recreation use levels presented in SP-R1 and the traffic LOS data presented in SP-R8.

The potential increase in demand for parking in the project area resulting from project construction and/or operation will be determined for each of the primary action alternatives. Parking impacts will be identified based on the results of SP-R1, SP-R8, and SP-R12.

4.21 UTILITIES AND SERVICE SYSTEMS

4.21.1 Types and Causes of Potential Impacts

The primary alternatives will be evaluated for potential impacts on utilities and service systems. The analysis may consider potential effects on:

- The Oroville Facilities water and electrical supply systems;
- Electrical transmission lines, interconnection facilities, substations (e.g., PG&E's Table Mountain Substation) and distribution lines;
- Natural gas distribution lines;
- Sewer lines and wastewater treatment systems; and
- Landfills.

The analysis may also consider potential impacts on or conflicts with physical structures (e.g., where they are located). It is also expected to examine the potential for the alternatives to increase the demands placed on these systems and require new construction or expansion of facilities.

Appendix B provides descriptions of key features of water and electrical supply systems in the study area. Additional information on other utilities and service systems will be provided in this section in the January 2005 PDEA.

4.21.2 Methods of Analysis

The methods that will be used to conduct this analysis may include:

- Researching locations and capacities of existing utilities and service system infrastructure to determine the ability of these facilities to accommodate the demand generated by the primary alternatives;
- Determining availability of water supplies for any new facilities or development;
- Researching utility and other infrastructure projects or expansions being planned in the study area; and

- Consulting with utilities such as PG&E, water districts, landfill operators, and wastewater treatment facility operators to discuss potential effects on their infrastructure systems and mitigation measures if needed.

4.22 WATER QUALITY

4.22.1 Types and Causes of Potential Impacts

Section 303 of the federal Clean Water Act (CWA) requires states to adopt water quality standards that "…consist of designated uses of the navigable waters involved and water quality criteria for such waters based upon such uses." The SWRCB carries out its water quality protection obligations and authority through the adoption of specific Water Quality Control Plans (Basin Plans) (e.g., the Delta Basin Plan). Basin Plans establish water quality standards for particular water bodies by designating beneficial uses of those waters and water quality objectives to protect those uses. Moreover, the Central Valley RWQCB provides additional protection of water quality within the Central Valley region by designating additional, water body–specific objectives in its own Basin Plan. Because beneficial uses, together with their corresponding water quality objectives, can be defined per federal regulations as water quality standards, these plans regulate State and federal requirements for water quality control.

The Basin Plan for the Central Valley RWQCB designates the following beneficial uses for the Feather River, Lake Oroville, and other water bodies affected by the Oroville Facilities:

- Municipal and domestic supply;
- Agriculture;
- Electrical power production;
- Contact and noncontact recreation;
- Cold and warm freshwater habitat;
- Fish spawning, rearing, and migration habitat; and
- Wildlife habitat.

The RWQCB considers these beneficial uses adversely affected if water quality objectives are not met for a variety of water quality parameters. Water quality parameters that may be compliance issues for the Oroville Facilities are:

- Temperature;
- Dissolved oxygen;
- Bacteria;

- Petroleum byproducts;
- Pesticides;
- Sedimentation and turbidity;
- Mercury and other metals; and
- Toxicity.

The primary alternatives have the potential to affect water quality in the study area, as they could result in water quality objectives of the Basin Plan of the Central Valley RWQCB not being met. The analysis of factors affecting water quality in the study area will consider the following potential impacts:

- Effects of Lake Oroville storage releases on water temperatures in the Thermalito Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the OWA, the low-flow channel of the Feather River, and downstream areas;
- Temperature-related effects on habitat for salmonids and other aquatic resources, the Feather River Fish Hatchery, and agriculture;
- Effects related to availability of cold water in Lake Oroville for release in various water year types under current and future operational demands (access to the coldwater pool during below-normal and multiple below-normal water years under existing and future operational demands, and effectiveness of the temperature control device in providing this access, are of particular concern);
- Effects of hatchery operations and facilities on water temperature and other water quality parameters in the Feather River and Thermalito Afterbay (hatchery source water, water temperature effects on fish habitat and rice germination, and poor water quality from the hatchery settling ponds are issues identified);
- Effects of pump-back operations on water temperature and other water quality parameters in Lake Oroville, the Thermalito Diversion Pool, Thermalito Forebay, Thermalito Afterbay, and OWA (consequences of water temperature conditions on rice germination and on habitat suitability and migration cues of salmonids are issues identified);
- Water temperature and organic content in Thermalito Afterbay, and potential increase in methyl mercury levels;
- Effects of recreational facilities and activities on erosion, sedimentation and turbidity, and introduction of nutrients and bacteria;
- Other water quality concerns related to recreation including MTBE, oils and greases, fuel spills, floating gas tanks, floating septic systems, floating restrooms, houseboat gray water tanks, and pump-out facilities;

- Sediment deposition and potential impoundment of toxic metals (especially the potential presence methyl mercury and its uptake through the food chain);
- Contaminants (mercury and pesticides) in fish tissues;
- Ammonia from decomposing salmon carcasses in the Feather River downstream of the Fish Barrier Dam;
- Effects on migration of anadromous salmonids to upstream tributaries and resulting effects on the nutrient status of the tributaries;
- Effects on the physical, chemical, and biological components of water quality of the Feather River, affected tributaries, and downstream waters as they contribute to overall aquatic ecosystem health;
- Effects on natural protective processes (e.g., floodplains and marshes);
- Potential acid mine drainage to Thermalito Forebay from Table Mountain;
- Effects of cattle grazing in the basin on sedimentation and bacteria;
- Effects of project operations on nitrogen supersaturation;
- Effects of fuel use and management on reservoirs;
- Potential for non-project-related toxic spills (e.g., from railroad operations) and effects of toxic spills on project waters;
- Effects of gold mining (e.g., elemental mercury in sediments);
- Effects of reservoirs and Feather River downstream of Oroville Dam on groundwater quality; and
- Cumulative effects of project operations and other past, present, and reasonably foreseeable future actions on water quality characteristics that are crucial to Oroville Facilities resource issues.
- The primary alternatives also have the potential to cause the following temporary construction-related water quality effects:
- Erosion, sedimentation, and turbidity from construction of new recreation facilities and other project facilities, and habitat restoration and enhancement activities; and
- Potential for toxic spills (e.g., concrete, oil and grease, fuels) and effects of toxic spills on project waters.

4.22.2 Methods of Analysis

This section presents descriptions of the methods of analysis employed in ongoing technical studies of current water quality conditions and, in general terms, the methods that will be used to analyze potential project impacts. The first part of this section provides a summary of the methods used in each of the ongoing technical water quality studies. The final part briefly describes the types of effects expected to result from implementation of the primary alternatives and provides general descriptions of how these effects will be evaluated.

4.22.2.1 Methods Used in Technical Water Quality Studies

DWR staff is conducting seven different technical studies to survey existing water quality conditions and to identify factors affecting beneficial uses in the lower Feather River, the water bodies of the Thermalito Complex, and Lake Oroville and its tributaries. These studies will be used to support the water quality impact analyses and address the following resource areas:

- Surveys of more than 200 water quality variables, including physical, chemical, biological, bacteriological, and trace metal parameters, and pesticides and other synthetic organic compounds at more than 50 locations in the Feather River basin (Study Plan [SP] W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Water). Water samples are being collected at regular intervals from a number of stations upstream of Lake Oroville, in the reservoir and other project impoundments, in the OWA ponds, and in the lower Feather River. Samples are also being irregularly collected to evaluate stormwater ("first flush") conditions.
- An investigation of levels of metals and organic contaminants in fish tissue and sediments from selected water bodies in the project area (SP-W2, Contaminant Accumulation in Fish, Sediments, and the Aquatic Food Chain). Contaminants are being analyzed in fish and sediments collected at 16 locations in Lake Oroville, the Thermalito Diversion Pool, Thermalito Forebay, Thermalito Afterbay, OWA, and the lower Feather River. According to the original sampling plan, crayfish were also to be collected at four of these sites. Game species within the legal size limits were the primary target fishes. Nongame native species were also collected.
- A survey of existing recreational facilities and activities in Lake Oroville and other project waters and their effects on water quality (SP-W3, Recreational Facilities and Operations Effects on Water Quality). The first phase of this study, which was completed, described potential water quality issues for each recreational facility in the project area and proposed monitoring protocols to identify and evaluate potential effects on water quality. The second phase of the study will implement the monitoring plan described in the Phase 1 report.
- A survey of groundwater quality (SP-W5, Project Effects on Groundwater). In the first phase, which was completed, existing groundwater monitoring data were reviewed to determine whether they are adequate for evaluating project effects. This report concluded that the existing data show that the groundwater levels near Thermalito Forebay are affected by the project, but that water quality data from wells near Thermalito Forebay and Thermalito Afterbay are not adequate for

evaluating project effects. Because of local geologic conditions, only groundwater in the vicinity of Thermalito Forebay and Thermalito Afterbay has the potential to be affected by the project. To obtain the additional information needed, the second phase of this study will be implemented. Groundwater samples will be collected during spring and fall from a number of existing wells and other structures located in the vicinity of the forebay and afterbay.

- A monitoring and modeling study of water temperatures (SP-W6, Project Effects on Temperature Regime). Water temperature data will be collected from all project water bodies. Stream and discharge (e.g., fish hatchery and Thermalito Afterbay outlets) temperatures will be collected with continuously recording temperature loggers, while temperatures at different depths in Lake Oroville and other impoundments, as well as river pools and salmon spawning areas, will be determined at frequent intervals using a thermistor. The environmental analyses will use results of temperature modeling to estimate water temperatures following implementation of the Proposed Action and primary alternatives. Empirical data and modeling results will be used to evaluate current and future project compliance with applicable water temperature goals, criteria, or standards.
- A survey of land uses in the basin and their potential effects on water quality (SP-W7, Land and Watershed Management). An initial study has been completed that defines land uses within 0.5 mile of the project. Land uses fall into several broad categories, including agriculture, commercial, industrial, railroad, residential, roads and streets, and miscellaneous, which includes lands under jurisdiction of State or federal entities. The report identifies several land uses or management activities that may affect project waters and proposes monitoring sites to evaluate the effects. The proposed monitoring would evaluate erosion from agricultural practices, runoff from commercial land uses, urban runoff, and chemical control of pest populations. Many of the sites are already included in the SP-W1 study plan, but some additional sites are proposed.
- An investigation of natural protective processes within and along the lower Feather River that help to restore and maintain good water quality (SP-W9, Project Effects on Natural Protective Processes). This study will evaluate project effects on natural water quality protective processes in riparian, wetland, and riffle areas. The study will rely largely on the results of literature reviews and of other technical studies for the Oroville Facilities relicensing process.

4.22.2.2 Analyzing Project Impacts

The primary alternatives have not been fully described, although the descriptions are due to be available by spring 2004. Also, the results of many of the technical reports that are needed for evaluating project impacts are currently not available. Therefore, complete descriptions of the methods of analysis for potential impacts were not developed for this report. However, the likely general effects of the primary alternatives are understood, so general descriptions of the methods for analyzing water quality impacts of these effects have been developed. The likely general effects of the project and the methods for analyzing these effects are presented below.

Two distinct types of water quality effects can be evaluated within the local or regional study area: (1) short-term effects related to construction activities, and (2) long-term effects related to changes in the Oroville Facilities and their operations. Construction activities associated with new recreational facilities and habitat enhancements for the Proposed Action and primary alternatives have the potential to cause short-term water quality effects as a result of earth moving activities and use of motorized construction equipment. Earthmoving activities may result in severe sedimentation and turbidity, unless appropriate mitigation practices are implemented. Use of motorized equipment may lead to an influx of petroleum byproducts and other toxic materials.

Assessment of long-term water quality impacts associated with the Oroville Facilities and operations occurring under the primary alternatives is more complex. As previously noted, specific and detailed descriptions of the primary alternatives, as well as many results of studies to evaluate project effects, are currently unavailable. However, even when such descriptions and results are available, methods of assessing water quality impacts will necessarily be largely qualitative because processes affecting most water quality variables are not well enough understood to quantitatively predict project effects. The one exception is water temperatures, for which prediction with reasonable accuracy will likely be feasible using the water temperature models that have been developed in the Engineering and Operations technical studies. The following provides general descriptions of methods that will be used for evaluating water quality impacts of each major type of project effect identified in the previous section.

<u>Effects of Increased Recreational Activities</u>
Many of the potential long-term operations-related water quality effects under the primary action alternatives would be associated with the expansion of recreational activities or with project operations that cause changes in the hydrological regime. The creation of new recreation facilities would lead to increases in the number of users, which would potentially result in higher levels of pathogens around new campgrounds and swim areas, higher levels of petroleum byproducts and other pollutants, increased erosion and sedimentation as a result of increased use of trails, and higher angler use and consumption of contaminated fish.

Estimates of future recreation use levels will be obtained from the results of SP-R12, Projected Recreation Use. Effects of the future use levels on water quality will be assessed by extrapolating from effects of current use levels for each type of recreational activity as determined from the results of SP-W3, the technical study of recreational activity effects on water quality. If extrapolations from current use levels indicate that future water quality parameters would likely comply with Basin Plan objectives, the increased recreation would in most cases be considered to have a less-than-significant adverse water quality impact. However, if the extrapolations show that substantial water quality degradation is likely, the increased recreation would be considered to have a significant adverse impact regardless of whether or not Basin Plan objectives were met. Under these circumstances, mitigation measures would be required. Recreational activities that adversely affect water quality parameters that currently are not comply with Basin Plan standards would definitely result in a significant project impact if these activities were increased, unless mitigation measures were adopted or other project actions mitigated their effects.

Effects of Changes in Reservoir Levels

Changes in operations would potentially result in changes in surface elevations of Lake Oroville and other project impoundments, and in the flow regime of the lower Feather River. Changes in surface elevations would likely affect temperature stratification and the volume of the coldwater pool in Lake Oroville. Changes in the flow regime of the lower Feather River would potentially have significant water temperature effects and might affect DO levels, sedimentation and turbidity, and other water quality parameters. Changes in operations would also likely affect water temperatures in Thermalito Forebay and Thermalito Afterbay, with potential direct effects on agriculture and indirect effects on methyl mercury concentrations and levels of mercury in fish. Increased water elevation in Thermalito Forebay and Thermalito Afterbay would potentially affect groundwater conditions.

Hydrologic models and the SP-E1.3, SP-E1.5, SP-E7, and SP-E8 water temperature models will provide predictions of the effects of changes in project operations on surface water elevations of Lake Oroville and other project impoundments and the water temperatures in these reservoirs. These predictions will be used to assess potential effects on DO levels and water quality parameters affected by DO, as well as methyl mercury levels in Thermalito Afterbay.

Effects of Changes in Feather River Flows

Hydrologic models and the SP-E1.4 water temperature model will provide predictions of the effects of changes in project operations on streamflows and water temperatures in the low-flow channel of the Feather River and the Feather River downstream of the Thermalito Afterbay outlet. These predictions will be used to assess potential effects on DO levels in deep river pools and spawning grounds. Assessment of water quality impacts will be based on Basin Plan and other standards and on known requirements of salmonid fish species in the river, as identified by the fisheries technical studies, SP-F10, Evaluation of Project Effects on Salmonids and their Habitat in the Feather River Below the Fish Barrier Dam, and other studies.

Temporary Construction-Related Effects

The impacts of construction activities associated with the Proposed Action and primary alternatives would also be evaluated for potential temporary water quality impacts. The construction of new recreational facilities or fish habitat enhancements will be assessed by evaluating the likely Best Management Practices (BMPs) that would be adopted to mitigate anticipated construction effects. Evaluations will entail determining the erosion, sedimentation, and contamination effects likely to result from proposed construction activities; the particular vulnerabilities of any water body exposed to the construction activities; and professional judgment regarding the probable effectiveness of the BMPs. If the mitigation effects of the BMPs were judged to be inadequate, the construction activities would be considered to have significant adverse impact(s) on water quality.

4.22.2.3 Related Study Plans

Analysis of potential effects on water quality will rely on the results, if available, of the following study plan reports:

- SP-W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Water;
- SP-W2, Contaminant Accumulation in Fish, Sediments, and the Aquatic Food Chain;
- SP-W3, Recreational Facilities and Operations Effects on Water Quality;
- SP-W5, Project Effects on Ground Water;
- SP-W6, Project Effects on Temperature Regime;
- SP-W7, Land and Watershed Management;
- SP-W9, Project Effects on Natural Protective Processes;
- SP-E1.3, Oroville Reservoir Temperature Model Development;
- SP-E1.4, Thermalito Complex Temperature Model Development;
- SP-E1.5, Feather River Temperature Model Development;
- SP-E7, Oroville Reservoir Cold Water Pool Evaluation;
- SP-E8, Temperature Impacts of Pumpback Operation on Oroville Reservoir Cold Water Pool;
- SP-T3/5, Riparian Resources, Wetlands and Associated Floodplains;
- SP-G2, Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam;
- SP-R12, Projected Recreation Use; and
- SP-F10, Evaluation of Project Effects on Salmonids and their Habitat in the Feather River Below the Fish Barrier Dam.

4.23 WILDLIFE RESOURCES

This section addresses wildlife species, including special-status species, harvest and recreationally/commercially important species, and associated habitats. Special-status wildlife species are separated into two groups:

- Species listed as Threatened or Endangered (“listed species”) under the CESA and/or FESA and candidate species for listing, or taxa that meet criteria for listing (§15380 of CEQA); and
- Species that are recognized by resource groups or by regulatory or land management agencies as requiring protection and special consideration because they have a critical, vulnerable stage of their life cycle; are closely associated with habitat that is declining in California (wetlands, riparian habitat, or vernal pools); or are unique, have a restricted distribution, or are in decline.

4.23.1 Types and Causes of Potential Impacts

The primary alternatives have the potential to affect wildlife resources in the study area. Existing dams and hydroelectric projects may cause direct and indirect impacts on wildlife and associated habitat. Short- and long-term impacts may result in changes to the dynamics and stability of existing wildlife communities, including changes in species diversity and wildlife distribution, and may affect reproductive success. Direct and indirect impacts may result from the following:

- *Changes in Lake Oroville water levels:* Water levels in Lake Oroville fluctuate in response to needs for power production, flood control, and water withdrawals for irrigation or municipal water use. Daily and seasonal fluctuations in water levels generally favor the establishment of upland plant communities along the shoreline instead of riparian vegetation more typically associated with natural lakes. The zone exposed in late summer, fall, and winter by reservoir drawdown usually does not support any vegetation and may be subject to erosion. Areas exposed by a spring/early summer drawdown may support some vegetation if conditions are favorable, but plant biomass and diversity within this habitat is usually low and can be dominated by non-native, weedy species that provide limited, poor quality wildlife habitat. In addition, the barren zones created by reservoir drawdown can affect the ability of wildlife to access water, which in turn causes them to be more vulnerable to predation.
- *Thermalito Afterbay water level fluctuations:* Relatively minor water level fluctuations occur at the Thermalito Diversion Pool, Thermalito Forebay, and within dredger ponds associated with OWA. However, Thermalito Afterbay water level fluctuations are more extreme and can adversely affect critical life stages of certain wildlife species, including nesting and brooding waterfowl and nesting grebes. Exposed mudflats that occur during some Thermalito Afterbay fluctuations provide habitat for a variety of wildlife species, but they can also

serve to increase predation and loss of species attempting to traverse them to reach either cover or open water.

- *Altered discharge to streams and rivers:* Dams and hydroelectric project operations affect downstream hydrology by altering flow magnitude, timing, and duration. Fisheries operations and other procedures to accommodate the needs of specific species may also affect the timing and quantity of hydrologic flows. These hydrological variations often affect streambank habitat by altering erosion and sediment deposition processes and by affecting recruitment and survival of riparian plant species. In addition, hydroelectric project operations can affect wetlands that may be hydrologically connected to the river. Changes to riparian and wetland areas can affect the amount, quality and connectivity of habitat available to wildlife, with the greatest impacts on obligate species that depend on these habitats for food and cover.
- *Ground/soil disturbance and habitat degradation from operations and maintenance activities:* Project maintenance and/or operations may affect wildlife habitat by disturbing surfaces, resulting in direct elimination of habitat, degradation of habitat quality, and/or displacement of wildlife. Impacts on habitat may be direct, through removal and development, or indirect, through disturbance or nonselective application of herbicides and pesticides that allow establishment of noxious weeds and other non-native species. These non-native species often cause competitive exclusion of habitat components and/or of wildlife populations. Nonselective application of herbicides and pesticides can also degrade sensitive habitats such as wetlands and vernal pools, thus affecting wildlife populations dependent upon these habitats.
- *Disturbance from project-related recreation:* Wildlife and wildlife habitat may be directly and indirectly affected by project-related recreation. Development and use of recreational facilities causes direct loss of habitat as vegetation is removed or altered and soil is disturbed. These processes also promote the establishment of non-native plant species, which alter habitat structure and composition. Recreational activity often results in accumulation of trash and garbage, attracting non-native wildlife species, which may then displace resident wildlife. The availability of additional food can also change the composition and population dynamics of native species, increasing the abundance of raccoons, rodents, gulls, and crows. Additionally, recreational developments typically include nocturnal lighting and structures, which may cause resident wildlife to avoid the area. Increased human presence can also cause avoidance by some resident wildlife.

The analysis of impacts on wildlife and habitats within the study area from the primary action alternatives will be quantified to the extent that terrestrial study data and results allow. The analysis will focus on the following specific geographic areas within the study area (as shown in a figure to be included in the January 2005 PDEA):

- Lake Oroville;
- The Thermalito Diversion Pool;
- The high-flow channel;
- Thermalito Forebay and Thermalito Afterbay;
- The OWA;
- The low-flow channel of the Feather River; and
- The Feather River from the Thermalito Afterbay outflow to the confluence with the Sacramento River.

The analysis of potential impacts on wildlife resources will consider:

- Effects of existing and future project operations on wildlife and wildlife habitats (operational factors to be considered include power generation, water storage and release, ramping rates, pumpback, water levels, and water level fluctuations);
- Effects of existing and future project maintenance activities on wildlife and wildlife habitats (activities to be considered include road, trail, and parking lot maintenance such as paving and grading; bridge maintenance, such as repainting, redecking, and safety inspections; fuel breaks; drainage improvements and new flood protection measures; and invertebrate and vertebrate pest and noxious weed control);
- Effects of existing and future project-related recreation facilities and uses (authorized and unauthorized access, use and management practices) on wildlife habitats and important wildlife use areas, including but not limited to those listed below:
    - Riparian habitat;
    - Floodplain habitats;
    - Wetlands;
    - Vernal pools;
    - Native upland grassland;
    - Migratory and movement corridors;
    - Nursery, nesting, and brooding areas; and
    - Wintering areas;
- Effects of existing and future project operations, maintenance, and associated recreation on wildlife species that are listed, proposed, or candidates for listing under FESA and/or CESA as Threatened, Endangered, or Sensitive; Species of

Special Concern; special-interest species; and their habitats. Special-status species that will be addressed include, but are not limited to, those included in Table 4.23-1.

Table 4.23-1. Special-status species that will be addressed in the PDEA analysis of effects on wildlife resources.

Wildlife Species	Listing Status	
	Federal	State
Conservancy fairy shrimp	E	-
Vernal pool tadpole shrimp	E	-
Southern bald eagle	T; proposed for delisting	E
Giant garter snake	T	T
California red-legged frog	T	SSC
Delta smelt	T	-
Valley elderberry longhorn beetle	T	-
Vernal pool fairy shrimp	T	-
Western yellow-billed cuckoo	C	E
Mountain yellow-legged frog	C; may be dropped based on USFWS guidance of 2/13/04	-
American peregrine falcon	SC	E
Swainson's hawk	MBTA	T
Greater sandhill crane	MBTA	T
Bank swallow	MBTA	T
California tiger salamander	PT; may be dropped based upon USFWS guidance of 2/13/04	-

Source: DWR 2004.
NOTES: C = candidate for listing; E = listed as Endangered; MBTA = protected under the Migratory Bird Treaty Act; PT = proposed as Threatened; SSC = State Species of Special Concern; SC = federal Species of Concern; T = listed as Threatened

- Effects of existing and future project operations and project-related recreation facilities and uses on harvest of commercially and recreationally important species and their habitats, including but not limited to migratory waterfowl, black bear, winter habitat for band-tailed pigeon, and winter range for black-tailed mule deer;
- Effects on the introduction, distribution, and management of undesirable non-native wildlife species;
- Effects of land use changes (e.g., cattle grazing, gravel harvest, fuels management) associated with project operations and maintenance on wildlife and wildlife habitat;

- Effects on wildlife and wildlife habitat of existing and proposed management plans and interagency coordination and activities; and
- Specific effects on opportunities for wildlife habitat restoration and on bank swallow habitat of existing and future project operations occurring on floodplains and in project water fluctuation zones.

4.23.2 Methods of Analysis

4.23.2.1 Terrestrial Resources

- SP-T1, Effects of Project Features and Operation on Wildlife and Wildlife Habitat identifies methods of impact assessment related to operations and maintenance including:
    - Streamflow frequency assessment to identify timing, magnitude, and frequency of flow events to maintain bank swallow nesting habitat;
    - Stage-discharge modeling to identify impacts associated with water supply operation impacts on nest bank swallows;
    - Monitoring of experimental reoperation of the Thermalito Afterbay spring water level fluctuations to minimize impacts to nesting waterfowl;
    - Monitoring of waterfowl brood pond water level fluctuations and identification of recharge requirements;
    - Field survey and identification of species use of reservoir drawdown zones (timing, habitat quantity and quality);
    - Mapping of direct habitat loss and subsequent identification of areas suitable for habitat restoration;
    - Mapping of vernal pools and elderberry shrubs in relation to project maintenance activities (grading, paving, disking, pesticide use, earthmoving);
    - Assessment of active peregrine falcon nest sites and development of enhancement measures related to operations and maintenance activities;
    - Evaluation of commercial gravel harvest as a restoration tool including identification of areas potentially suitable for this restoration technique;
    - Qualitative seasonal field assessment of the wildlife impacts associated with livestock grazing;
- SP-T2, Project Effects on Special Status Species:
    - Streamflow frequency assessment to identify timing, magnitude, and frequency of flow events to maintain bank swallow nesting habitat;

- Stage-discharge modeling to identify impacts associated with water supply operation impacts on nest bank swallows;
- Mapping of vernal pools and elderberry shrubs in relation to project maintenance activities (grading, paving, disking, pesticide use, earthmoving);
- Field survey of potentially suitable habitat for special status species use employing methodologies delineated in SP-T2;
- Delineation of bald eagle primary and secondary zones for the protection on nesting eagles. These zones identify timing and compatibility of recreation, development, land use, and maintenance activities, as well as habitat improvement measures;
- Identification and mapping of vernal pools subject to off-road vehicle impacts and operations and maintenance activities, and development of protection measures;
- Assessment of active peregrine falcon nest sites and development of enhancement measures related to operations and maintenance activities;
- Mapping and identification of areas and methods for potential FESA and/or CESA species habitat improvements;

∉ SP-T3/5, Riparian Resources, Wetlands and Associated Floodplains:

- Assessment of project affects on recruitment/retention of riparian vegetation/habitat;

∉ SP-T6, Interagency Wildlife Management Coordination and Wildlife Management Plan Development:

- Collection and evaluation of land management agency’s wildlife management plans and policies; and
- Assessment of project affects on recruitment/retention of riparian vegetation/habitat;

∉ SP-T4, Biodiversity, Vegetation Communities and Wildlife Habitat Mapping:

- CWHR habitat modeling to determine baseline wildlife biodiversity and for use as a tool for impact assessment;

∉ SP-T8, Project Effects on Non-native Wildlife:

- Identification of areas of potentially suitable habitat based on CWHR modeling and analyses;
- Evaluation of current maintenance practices with recommendation (based on non-native species literature review) for control measures;

∉ SP-T9, Recreation and Wildlife:

  - Identify recreation/wildlife impacts related to FESA and/or CESA species and develop management plans to minimize impacts (vernal pool invertebrates, bald eagle nest territories, peregrine falcon nest territories, and valley elderberry longhorn beetle [VELB]) based on survey data;
  - Evaluate the impact of recreational use on nesting waterfowl using nest transect data;
  - Evaluate power boat impacts to nesting grebe reproduction on the Thermalito Afterbay;
  - Evaluate existing recreational use and facilities within OWA for compatibility with wildlife management objectives;
- SP-T10, Effects of Project Features, Operations and Maintenance on Upland Plant Communities; and
- SP-T11, Effects of Fuel Load Management and Fire Prevention on Wildlife and Plant Communities:
  - CWHR modeling of the species changes resulting from three fuels management options on State lands in the Kelly Ridge area.

Interim and final results for the following terrestrial study plans are available. Information contained in these study plans may support the impact analysis described above:

- SP-T1 Interim Report (February 2003);
- SP-T2 Progress Summary (November 6, 2002);
- SP-T4 Interim Report (June 23, 2003);
- SP-T7 Interim Report (April 18, 2003);
- SP-T9 Interim Report (January 2003);
- SP-T8 Draft Final Report (September 2003);
- SP-T11 Draft Final Report (October 2003);
- SP-T2 Draft Final Report (January 2004); and
- SP-T4 Draft Final Report (January 2004)

4.23.2.2 Geomorphic Processes

- SP-G1, Effects of Project Operations on Geomorphic Processes Upstream of Oroville Dam; and
- SP-G2, Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam.

4.23.2.3 Fisheries

- SP-F3.1, Evaluation of Project Effects on Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area;
- SP-F3.2, Evaluation of Project Effects on Non-salmonid Fish in the Feather River Downstream of the Fish Barrier Dam; and
- SP-F16, Evaluation of Project Effects on Instream Flows and Fish Habitat.

Final reports of the above studies are not available.

4.23.2.4 Land Use

- SP-L1, Land Use;
- SP-L2, Land Management;
- SP-L3, Comprehensive Plan Consistency; and
- SP-L5, Fuel Load Management.

The SP-L5 Interim Report (June 2003) provides a status update of current fuel load conditions, reviews relevant fuel load reduction and management techniques, summarizes the programs and policies of land management and other local agencies, and suggests fuel load reduction measures. The Final Fuel Load Management Evaluation was submitted in September 2003.

No other land use reports are available.

4.23.2.5 Recreation

- SP-R3, Assess Relationship of Project Operations and Recreation;
- SP-R4, Assess Relationship of Fish/Wildlife Management and Recreation;
- SP-R5, Assess Recreation Areas Management;
- SP-R7, Reservoir Boating Survey;
- SP-R9, Existing Recreation Use Study;
- SP-R11, Recreation and Public Use Impact Assessment;
- SP-R12, Projected Recreation Use;
- SP-R13, Recreation Surveys;
- SP-R16, Whitewater and River Boating; and

- SP-R17, Recreation Needs Analysis.

Recreation use data are provided in "SP-R7, SP-R9, SP-R13 Interim Report Critical Path Recreation Field Studies," which presents results of recreation surveys focused on Lake Oroville. This information is of limited use for the impact analysis outlined above.

4.23.2.6 Water Quality

- SP-W7, Land and Watershed Management; and
- SP-W9, Project Effects on Natural Protective Processes.

The SP-W7 Progress Report (January 2003) identifies potential effects on water quality. The final report is necessary for the impact analysis.

4.23.2.7 Engineering and Operations

- SP-E1, Model Development;
- SP-E1.6, Feather River Flow Stage Model Development;
- SP-E2, Perform Modeling Simulations;
- SP-E3, Evaluate the Potential for Additional Hydropower Generation at Oroville; and
- SP-E4, Flood Management Study.

Bookend modeling scenarios of flow regimes (SP-E2) are required for the impact analysis.

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5.0 OTHER STATUTORY REQUIREMENTS

5.1 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA §102(C)(v) CEQ Regulations Part 1502.16) requires federal agencies to consider to the fullest extent possible any irreversible and irretrievable commitments of resources that would be involved in a proposed action should it be implemented. FERC guidelines for following NEPA regulations are contained in “Preparing Environmental Assessments: Guidelines for Applicants, Contractors, and Staff” (FERC 2001).

An irreversible effect is one that cannot be reversed, for example when a species becomes extinct. An irretrievable effect is one that is sustained for a certain period of time but is reversible. For example, while an area is used as a ski area, some or all of the timber production there is irretrievably lost. If the ski area closes, timber production could resume; the loss of timber production during the time that the area was devoted to winter sports is irretrievable. However, the loss of timber production during that time is not irreversible, because it is possible for timber production to resume if the area is no longer used as a ski area.

Under the ALP (authorized by FERC), issues associated with the Oroville Facilities relicensing have been identified, studies have been designed and are under way to assist in analyzing the project effects, and stakeholder work groups are in the process of identifying potential PM&E measures. In addition, complex hydrologic modeling is being conducted by DWR and its consultants.

Because neither the key study plan results nor the key modeling results are currently available, the primary action alternatives have not yet been fully developed. Thus, this PDEA Progress Summary cannot contain an analysis of impacts. The PDEA that will be submitted to FERC in January 2005 with the License Application will contain a full environmental analysis of the Proposed Action and a range of alternatives, including an analysis of irreversible and irretrievable commitments of resources.

5.2 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

NEPA also requires federal agencies to disclose the relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity. This information is necessary so that the decisionmakers and members of the public have a clear sense of what they would gain or lose in the short and long term. Definition of the terms "short term" and "long term" vary from project to project, depending on the project scope and resource-specific information.

The January 2005 PDEA will contain a full environmental analysis of the Proposed Action and a range of alternatives, including an analysis of the relationship between short-term uses and long-term productivity.

5.3 GROWTH-INDUCING IMPACTS

NEPA requires that environmental decision-making documents consider the direct and indirect growth-inducing impacts of proposed projects or actions. This includes the examination of indirect environmental impacts, including growth-inducing effects and other effects related to induced changes in land use patterns, population density, or growth rate (40 CFR 1508.8(b)).

Growth-inducing effects are not necessarily considered to be beneficial, detrimental, or of little significance to the environment. However, economic or population growth beyond that accommodated in local planning documents can lead to adverse environmental effects and impacts on public services in the affected area. Induced growth is considered a significant impact only if it directly or indirectly affects the ability of agencies to provide needed public services, or if it can be demonstrated that the potential growth, in some other way, significantly affects the environment.

To meet the requirements of NEPA, this section of the January 2005 PDEA will evaluate the Proposed Action and alternatives in the context of the following considerations. A project would be considered to have a growth-inducing effect if it would:

- Foster economic or population growth, or the construction of additional housing;
- Remove obstacles to population growth;
- Overburden existing or planned public services and infrastructure; or
- Encourage activities that could significantly affect the environment.

5.4 CUMULATIVE IMPACTS

5.4.1 Methodology

This section presents the methodology for addressing cumulative impacts for the Oroville Facilities relicensing in the January 2005 PDEA. DWR must rely on available guidance documents to comply with regulations regarding cumulative impact assessment, including the following:

- NEPA;
- FERC guidance documents (FERC 2001);
- Guidance developed in cooperation with the collaborative process for the Oroville Facilities relicensing (DWR 2002; Interagency Task Force 2000a, 2000b); and
- Guidance developed by the USFWS and NOAA Fisheries and presented to the work groups as part of the ALP (National Marine Fisheries Service 2001; pers. comm., Croom 2002; pers. comm., Harlow 2002).

The method used to assess cumulative effects is described below.

CEQ NEPA guidance describes an 11-step approach to assess cumulative effects (CEQ 1997). FERC provided guidelines for cumulative impact assessment related to hydroelectric license applications. USFWS and NOAA Fisheries also provided guidance on the scope of environmental analysis for the Oroville Facilities relicensing. Additionally, as part of the Oroville Facilities relicensing collaborative process, the Environmental Work Group prepared draft guidance to study cumulative effects.

A clear definition of cumulative impacts is needed to begin the process. Federal and State agencies vary slightly in their definitions of cumulative impacts. CEQ regulations for NEPA compliance define a cumulative impact as:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 CFR 1508.7)

Therefore, this cumulative effects assessment will examine the relative contribution of the impacts of the Oroville Facilities Relicensing to the overall cumulative effects.

The following process will be used to develop the information necessary to evaluate cumulative impacts. This process integrates the CEQ 11-step process, as well as guidance provided by agencies participating in the collaborative process for the Oroville Facilities relicensing. This approach involves:

- *Step 1.* Project Information: Description of the Oroville Facilities;
- *Step 2.* Scoping: Identification of resources and geographic and temporal scope;
- *Step 3.* Affected Environment: Description of baseline conditions;
- *Step 4.* Identification: Determination of potential effects;
- *Step 5.* Evaluation: Development and application of criteria and thresholds; and
- *Step 6.* Alternative modification: Development of PM&E measures.

These steps are described below.

5.4.1.1 Step 1. Project Information: Description of the Oroville Facilities

The first step is to develop information about the Oroville Facilities, operating constraints, and the relationships of these constraints to other projects. This includes a description of the Proposed Action, which will include specific PM&E measures, along with descriptions of the other primary alternatives. The Proposed Action and other primary alternatives will be presented in the January 2005 PDEA. A discussion of the purpose and need for the Oroville Facilities and the nature, extent, and use of water rights are also needed to understand operating constraints. Existing maintenance practices, existing agreements between State and federal agencies, and existing biological opinions associated with the operation of the SWP are also necessary for understanding cumulative effects associated with the Oroville Facilities.

5.4.1.2 Step 2. Scoping: Identification of Resources and Geographic and Temporal Scope

The initial scoping efforts for the Oroville Facilities relicensing included public meetings involving stakeholders, other governmental agencies, tribes, and interested individuals. DWR, through the collaborative process, agreed to conduct 71 studies that would collect information necessary to assess potential direct, indirect, and cumulative impacts associated with potentially affected resources. The Environmental Work Group identified geomorphology, water quality, aquatic resources, terrestrial resources, and resources subject to protection under the FESA and CESA as potentially affected resources relative to cumulative impacts. When the 71 studies are considered "final," the list of resources could be expanded.

The CEQ guidance states that a useful concept for determining appropriate geographic boundaries for a cumulative impact analysis is the “project impact zone.” The FERC guidance indicates that spatial boundaries should reflect the geographic reach of resource effects from other hydropower and non-hydropower activities. Thus, DWR will determine the area(s) that would be affected by the primary alternatives and list the resources that could be cumulatively affected by the primary alternatives. The geographic scope for physical, biological, and human communities (socioeconomic conditions) will be determined using the direct and indirect effects of the project.

Additionally, FERC guidance explains that the geographic scope depends on the specific resource in question. For example, in the case of anadromous fish, the geographic scope may be the river basin or mainstem river, while for an endangered plant it might be the stream reach and surrounding lands. The draft guidance from the Environmental Work Group indicates that the geographic boundary should be the point where current studies provide reasonable information that the primary alternatives could have a potential impact on a potentially affected resource.

The CEQ handbook indicates that identifying past, present, and reasonably foreseeable future projects is critical to establishing the appropriate geographic and time boundaries. FERC guidance indicates that the temporal scope should include a brief discussion of past, present, and future actions. According to the CEQ guidance, future actions can be excluded from analysis if the action is outside the geographic or temporal boundaries, if the action would not affect resources subject to cumulative effects analysis, or if the action would be arbitrary.

The cumulative effects evaluation would include the establishment of an “environmental reference point” for related past and future projects. An environmental reference point is different from an “environmental baseline.” The environmental reference point assumes a pre-project condition for assessing cumulative effects, while the environmental baseline assumes existing conditions for assessing direct and indirect impacts. The benefit of setting an environmental reference point is that it then becomes possible to describe the sequence of human actions and natural events that occurred and interacted in the past, leaving residual cumulative effects that continue to influence present environmental conditions (Senner et al. 2002).

5.4.1.3 Step 3. Affected Environment: Description of Baseline Conditions

The evaluation of cumulative impacts can occur only after the affected environment is described. For resources subject to cumulative effects, FERC divides the affected environment into two parts: (1) A discussion of past actions and activities within the geographic scope of analysis; and (2) the resource as it is today (i.e., “baseline conditions”). The affected environment is what currently exists and what would be affected by the primary alternatives.

5.4.1.4 Step 4. Identification: Determination of Potential Effects

With the information above, DWR can identify cumulative effects that would result from the incremental impact of the Proposed Action or other alternatives when added to other past, present, and reasonably foreseeable future actions (projects). An initial list of these projects is presented in Section 5.4.2. The cumulative effects assessment also will examine the relative contribution of the impacts of the Oroville Facilities relicensing to the overall cumulative effects.

To present this information clearly to the public, the CEQ and FERC guidance documents suggest development of matrix tables to identify and distinguish between direct, indirect, and cumulative effects. Direct effects are those that occur in the same place and time and are a direct result of the proposed action. Indirect effects can occur at a distance from the proposed action, or the effects may appear some time after the proposed action occurs. This information will be presented in the January 2005 PDEA for the Oroville Facilities relicensing.

5.4.1.5 Step 5. Evaluation: Development and Application of Criteria

The CEQ guidance states that significance determinations should be based on context and intensity and can be quantitative or qualitative, but should be directly related to cause-and-effect relationships. Initially, criteria must be developed for determining which other past, present, or future projects related to the proposed project should be included in the cumulative impact analysis. For example, criteria may include:

- Is the project within the Oroville Facilities project area?
- Does the project affect a resource that is or will be significantly affected by a number of separate projects, actions, or activities in the region? (e.g., poor air quality)

Then, to determine whether a potential cumulative effect would be significant, the analysis applies the same criteria used to evaluate direct and indirect environmental effects.

5.4.1.6 Step 6. Alternative Modification: Development of Protection, Mitigation, and Enhancement Measures

The CEQ guidance provides that the project proponent should avoid, minimize, or mitigate adverse effects by modifying or adding project alternatives. In the collaborative process, PM&E measures have been and will continue to be developed to reduce potential impacts and assist in crafting the Proposed Action. In fact, FERC guidance states that if there is a settlement agreement, it typically is analyzed as the “proposed action” or as an “action alternative.” Because the PM&E measures are developed and refined as study information becomes available, it is likely that the primary alternatives will be modified or expanded.

5.4.2 Related Actions, Including Reasonably Foreseeable Future Projects by Others

The potential related actions (i.e., past, present, and reasonably foreseeable future projects) listed below are being considered for inclusion in the cumulative impact analysis that will be presented in the January 2005 PDEA. This list includes potential related actions identified by the Collaborative established as part of the ALP. The list includes:

- Operating Criteria and Plan (OCAP) project;
- CALFED Bay-Delta Program (CALFED) implementation, including North and South Delta improvements;
- Central Valley Project Improvement Act (CVPIA) implementation;
- Poe Project—new license;
- Upper North Fork Feather River—new license;
- Oroville Wyandotte—new license;
- Sacramento Flood Control Project;

- Freeport Regional Water Project;
- USACE Comprehensive Study;
- Agricultural diversions;
- Yuba County Water Agency New Bullards Bar reoperation;
- Yuba and Feather River flood control projects;
- Watershed management improvement activities in which DWR is involved;
- Sacramento Valley groundwater studies;
- Sewerage Commission—Oroville Region (SCOR) discharge program;
- Upper Yuba River Studies Program;
- Transfer of 140,000 acres of PG&E lands to the Pacific Forest and Watershed Stewardship Council;
- Cherokee Mining Proposal; and
- Regional hatchery activities.

DWR is reviewing the above list as part of the process used to define "reasonably foreseeable" related actions by others. The following factors are being considered to help determine which of the potential related actions are reasonably foreseeable: status of a project's permitting and funding; compliance with NEPA, CEQA, and/or the FERC relicensing process; and status of other necessary approvals. The ability to define or model a project's potential effects is another important consideration for determining whether a potential related action should be included in the modeling used to help assess cumulative impacts. This modeling is described further in Section 4.2.

5.5 ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED IF THE PROJECT IS IMPLEMENTED

Although no specific requirements for significant and unavoidable impacts are set forth for EAs, NEPA requires an EIS to include a discussion of adverse environmental effects that cannot be avoided (40 CFR 1502.16).

Chapter 4.0, Affected Environment and Environmental Consequences, identifies the types of environmental impacts that could potentially result from implementation of the primary alternatives. In the January 2005 PDEA, mitigation measures will be identified to eliminate adverse impacts or reduce them to a less-than-significant level where feasible. However, in some cases, no mitigation, or only partial mitigation, will be feasible; such impacts are commonly referred to as significant and unavoidable.

In the January 2005 PDEA, this section will provide a summary, by resource area, of those impacts that would be significant and unavoidable if the primary alternatives were implemented.

6.0 DEVELOPMENTAL AND ECONOMIC ANALYSIS

The FERC Guidelines (FERC 2001) require that an environmental assessment include a “developmental analysis” evaluating the economic benefits of the proposed action, the estimated costs of the various alternatives, and environmental recommendations and their effect on project economics. This analysis typically evaluates power and economic benefits and costs of environmental measures. The FERC Guidelines indicate that for each alternative considered, the analysis should address the value of the following developmental resources: power generation, water supply, irrigation, navigation, and flood control.

This chapter of the January 2005 PDEA will analyze the use of available water resources of the Oroville Facilities to generate hydropower; to supply water for municipal, industrial, and agricultural uses; and to provide flood control. It also will estimate the economic benefits of the Oroville Facilities, the costs of the proposed PM&E measures included in the primary alternatives, and the effects of these measures on Oroville Facilities operations. It will follow FERC’s approved methodology as described in the above-mentioned Guidelines. Chapter 7.0, Comprehensive Development Analysis and Recommendations, takes a comprehensive look at how these resources, environmental impacts, and costs might best be balanced, based on project goals and constraints.

While DWR does not propose any modifications to the Oroville Facilities power plants, it may propose continuing to operate and maintain the Oroville Facilities for electric power generation with new PM&E measures. These measures could be either structural or operational and could affect future power generation amounts and associated costs, as well as cost of water deliveries.

6.1 POWER AND ECONOMIC BENEFITS OF THE PRIMARY ALTERNATIVES

6.1.1 Background

As described in Chapter 2.0, Purpose and Need for Action, the Oroville Facilities are a part of the SWP, and their continued operation is vital to ensuring efficient and cost-effective water supply deliveries throughout the State of California. The Oroville Facilities generate hydroelectric energy to meet a large portion of the State’s water supply pumping load and also provide other important ancillary electrical system benefits to the interconnected grid through the California ISO. Chapter 2.0 describes the storage facilities, hydroelectric power plants, pumping-generating plants, and other infrastructure that comprise the Oroville Facilities. It also describes the role of the Oroville Facilities as part of the SWP in the production of energy to supply pumping loads as well as ancillary services required by the interconnected electrical system.

6.1.2 Power Supply

The Oroville Facilities power plants operate in conjunction with other SWP power plants and the CVP. Oroville Facilities power operations are heavily constrained, and continued operation and maintenance of the power features of the Oroville Facilities must be consistent with the operational criteria dictated by the management of the SWP and CVP. The primary function of the power plants is to provide electricity to power pumps that move water within the SWP. Moreover, power is generated at the Oroville Facilities when water is released pursuant to the complex SWP operating criteria including maintaining adequate flood control storage, Feather River flow and temperature protocols established by regulatory agencies, statutory Delta water quality requirements, FRSA water rights obligations, and SWP water supply statewide.

Potential future power generation improvements were studied under Study Plan (SP) E3, Evaluate the Potential for Additional Hydropower Generation at Oroville, but it was concluded that none of the alternatives studied had sufficient economic viability under DWR's evaluation guidelines to warrant development at any time in the near future. Therefore, no new facilities are being proposed as part of DWR's relicensing efforts.

Based on DWR's operations models using long-term basin hydrology, it is estimated that the long-term average annual generation from the three existing Oroville Facilities power plants under current conditions is roughly 2.5 million MWh per year (DWR 2002). This level of generation can be expected to continue in the future under the No Action Alternative. The entire SWP consumes an average of 8.5 million MWh per year; Oroville Facilities power generation is a critical SWP component used to offset this large energy demand, thus maintaining the affordability of SWP water.

6.1.3 Water Supply

As stated above, Oroville Facilities operations are planned and scheduled in concert with operations of other SWP and CVP facilities. The economic benefits of the Oroville Facilities cannot be clearly understood without discussion of the value of the portion of the SWP water that is supplied by these facilities, and the water supply cost impacts that would occur if operational changes to the Oroville Facilities affecting future water deliveries are made as part of the FERC relicensing process.

In evaluating the water supply element of the Oroville Facilities, both current and future operations will be examined. Data from DWR Bulletin 132-01 (DWR 2002) will be used for a representation of recent operations. Using the 10-year period from 1991 through 2000, the developmental analysis will consider:

- The annual average of total SWP water deliveries;
- The average amounts of water provided annually to meet water diversion requirements on the Feather River; and

- The share of SWP water delivered each year to SWCs (for municipal and industrial consumption or irrigated agriculture) that is attributable to Lake Oroville.

For the long-term picture, the projected water supply schedule from the Oroville Facilities will be examined over the same timeframe as the power analysis, which under FERC's Guidelines uses a period of 30 years, in this case through the year 2034 (2005–2034).

6.1.4 Power Benefits

Consistent with FERC's approach to economic analyses, the power benefits of the Oroville Facilities will be equated to the sum that would be paid for the same amount of power supplied from alternative resources. Future inflation effects for benefits or costs beyond the license issuance date will not be considered. For the Oroville Facilities, the value of generation will be assumed to be equal to the values projected for the ISO zones North of Path 15 (NP-15) by the California Energy Commission (CEC). The seasonal rate structures will be evaluated and different energy rates will be applied for each hour of the day, matching the current average hourly load shape, to estimate an average energy value per MWh.

The operations modeling work currently being conducted for the Oroville Facilities relicensing studies uses current (2001) and future (2020) as the years for the level-of-development benchmark studies. FERC Guidelines require that the year in which the new license application is filed with FERC (in this case, 2005) be used as the base-case year in the developmental analysis and that the period of economic analysis be set at 30 years. Results of the above-mentioned benchmark modeling studies will be used to derive the base-case figures for the economic analyses of the primary alternatives for the Oroville Facilities.

The historical annual power generation figure will be considered to be representative of expected future conditions, if no changes to the existing Oroville Facilities are made (i.e., under the No Action Alternative). A detailed assessment will be made of the time-of-day power price projections prepared by CEC, as described above, to estimate future annual power benefits provided by the expected future annual generation under each of the primary alternatives.

6.1.5 Water Supply and Other Benefits

According to FERC practice, the economic value of a project's non-power benefits—i.e., water supply, irrigation, navigation, recreational, and flood management—are typically excluded from the developmental analysis, because water contractors, irrigators, recreationists, and downstream property owners, not the licensee, receive those benefits.

FERC practice also calls for the exclusion of project-related capital and operating costs incurred by other regulatory agencies, in this case California resource agencies other than DWR, such as DFG, DPR, and DBW. Thus, their expenditures for the management of game lands and the operation of public recreational facilities situated within the FERC boundary for the Oroville Facilities are not considered in this analysis.

Lastly, the developmental analysis excludes benefits and costs attributable to portions of the SWP outside the Oroville Facilities project boundary. Thus, DWR's income and expenditures related to the operation of pumping plants, electric generation facilities, and water conveyances that are not part of the Oroville Facilities licensed features are excluded from the developmental analysis.

Notwithstanding the above, an analysis will be performed for both the No Action Alternative (base case) and each primary action alternative of the base cost and incremental cost of water supply associated with the cost of paying for PM&E measures.

6.1.6 Project Annual Costs

Annual costs of each of the primary alternatives will be calculated by amortizing the net investment over the 30-year term of the economic analysis and adding the estimated annual operation and maintenance costs.

The economic analysis will not be entirely a first-year analysis in that certain costs, such as major capital investments for improvements, would not be experienced in a single year. The maximum period used to annualize such costs will be 30 years.

6.1.7 Economic Analysis

The values identified above will yield a reasonable estimate of power costs and benefits for the purposes of the economic analysis. The primary goals of the economic analysis will be to provide a basis for:

- Measuring the economic benefits of continued Oroville Facilities operation;
- Estimating the reduction in power benefits associated with implementation of proposed PM&E measures included in the various alternatives; and
- Estimating the cost of replacing power for any proposed PM&E measures that would reduce future Oroville Facilities power generation.

Because current costs will be used, future increases or decreases in various cost components will not be included in the evaluation of Oroville Facilities power or alternative power supply. Although the potential effects of inflation on the future cost of electricity will not be explicitly considered, hydropower generation is relatively insensitive to inflation compared to fossil-fueled generators. It should be recognized that this is an important economic consideration for SWP power production and use. Therefore, a longer term view than just the initial 30-year period used for this economic analysis is often taken into consideration by water resource project managers such as DWR when evaluating the total net benefits and costs associated with potential future improvements and/or PM&E measures.

The key parameters used for the economic analysis will be as follows:

- *Period of analysis and term of financing:* 30 years, DWR's average term of debt financing;
- *Interest/discount rate:* 6 percent, DWR's average cost of debt financing;
- *Net investment:* DWR's net investment as of December 31, 2004, based on projection of the balance of outstanding bonds for the Oroville Facilities at that time;
- *Licensing costs:* Licensing costs for the period covering 2002-2004 only (prior costs have already been included in annual O&M budgets for 1998–2001, and therefore will not be capitalized);
- *Annual O&M cost:* Annual O&M expenditures projected by DWR for the Oroville Facilities based on data published in DWR Bulletin 132-01 (DWR 2002);
- *Average annual generation:* Based on data published in DWR Bulletin 132-01;
- *Energy value:* Based on NP-15 power price projections prepared by CEC;
- *Annual water yield:* Calculated from information contained in DWR Bulletin 132-01; and
- *Water value:* Based on current and projected future water supply costs to the SWC.

6.1.8 Net Annual Benefits

Given the above annual costs and power benefits, the net annual benefits of the existing Oroville Facilities will be estimated as ([annual power value] – [annual project cost]). This figure will serve as the basis for the analysis of the No Action Alternative (i.e., continued operation of the Oroville Facilities under the FERC License) and each primary alternative.

6.2 COST OF PROTECTION, MITIGATION, AND ENHANCEMENT MEASURES

Certain measures proposed or recommended by stakeholders would affect project economics by adding to the energy production cost (requiring new capital expenditures or additional annual costs for operation and maintenance), which would need to be passed on to SWP Water Contractors. Other measures, such as reservoir operation changes and increased minimum flow releases into the Feather River, could reduce Oroville Facilities power production capability, thereby reducing annual power benefits in the future. This section of the January 2005 PDEA will show how proposed operational changes considered in the January 2005 PDEA would affect annual power generation by the Oroville Facilities.

The following will be compared for the No Action Alternative, a new reservoir operation plan, and a new minimum flow schedule:

- Capacity (MW);
- Average generation (MWh);
- Foregone capacity (MW);
- Foregone generation (MWh);
- Average water yield (af); and
- Foregone water yield (af).

To estimate the cost of measures that would change how the Oroville Facilities are operated, the cost of replacing lost energy and capacity will be added to any capital or annual operation and maintenance costs required to implement the measure. The cost of each measure will be shown as a levelized annual cost over the 30-year period of analysis. This section will list the measures considered in the PDEA, identify the entity or entities supporting each measure, and provide the estimated cost of implementation.

6.3 ECONOMIC COMPARISON OF THE PRIMARY ALTERNATIVES

This section of the January 2005 PDEA will provide a summary of the annual cost, power and water benefits, and annual net benefits for the No Action Alternative, the Proposed Action, and other primary action alternatives. The Proposed Action will include the proposed PM&E measures, both structural and operational, proposed by DWR. Both the economic and environmental basis for DWR's proposed project will be presented more fully in Chapter 7.0, Comprehensive Development Analysis and Recommendations.

Under the No Action Alternative, there would be no funding of new PM&E measures beyond what is currently being provided or arising from existing legal obligations, and the project would continue to provide 762 MW of capacity and generate an average of 2.5 million MWh of electricity annually. By contrast, under the primary action alternatives, DWR would implement various combinations of PM&E measures. This section will indicate the amount of increase or decrease in capacity and average annual generation resulting from the proposed PM&E measures. In addition, based on an estimate of the current cost of replacing the lost power with no consideration of inflation over the 30-year period of analysis, the average annual power value of the project under the No Action Alternative and under the primary action alternatives will be provided. The average annual cost, annual benefit, and resulting average annual net benefit will also be stated.

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7.0 COMPREHENSIVE DEVELOPMENT ANALYSIS AND RECOMMENDATIONS

Section 4(e) of the FPA provides that, in issuing licenses for nonfederal hydropower projects, FERC shall give equal consideration to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Furthermore, §10(a)(1) of the FPA provides that licensed projects:

> will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water power development, and for other beneficial public uses, including irrigation, flood control, water supply, and recreation [and other purposes referred to in §4(e) of the FPA].

7.1 COMPARISON OF THE PRIMARY ALTERNATIVES

The approach for evaluating the environmental and developmental effects of the primary alternatives is described in Chapters 3.0 and 4.0 of this PDEA Progress Summary. Once the primary alternatives have been determined, they will be thoroughly evaluated and attributes of each primary alternative compared in a table that addresses key resource areas and related issues as appropriate.

7.2 RECOMMENDED ALTERNATIVE

In the January 2005 PDEA, Section 7.2 will explain how the Proposed Action gives equal consideration to developmental and nondevelopmental resources and is best adapted to a comprehensive plan for the waterway. This section will consider the comparative environmental effects of the alternatives, their economic effects, and their consistency with relevant agency recommendations, comprehensive plans, and laws and policies.

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8.0 RECOMMENDATIONS OF FISH AND WILDLIFE AGENCIES

Under the provisions of §10(j) of the FPA, each hydroelectric license issued by FERC is required to include conditions based on recommendations provided by federal and State fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources potentially affected by the project. FERC is required to include the recommended conditions, unless it believes that they are inconsistent with the FPA or other applicable laws. Section 10(j) of the FPA states that whenever FERC believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable laws, FERC and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Section 4.7 of the FERC Hydroelectric Project Licensing Handbook (FERC 2001) outlines the §10(j) process for those relicensing applications filed under the ALP. Under the ALP, where the application contains a consensus for the proposed PM&E measures, FERC likely could avoid a §10(j) dispute resolution process. The following is a summary of the §10(j) process as provided in the FERC Handbook.

Submission of recommendations by fish and wildlife agencies marks the beginning of the process under §10(j) of the FPA. FERC will request preliminary §10(j) recommendations after the January 2005 PDEA is issued. It is anticipated that FERC will request preliminary recommendations in accordance with §10(j) from the USFWS, NOAA Fisheries, and DFG.

FERC may seek clarification of resource agency recommendations through a meeting or teleconference if requested by the resource agencies or determined appropriate by FERC. FERC will make a preliminary determination and identify any inconsistency of the fish and wildlife recommendations with the purposes and requirements of the FPA or other applicable laws. The preliminary determination will include an explanation of the basis of the determination and references to the environmental analysis. A copy of the environmental analysis (usually in the NEPA Draft EA or Draft EIS) will be provided with the determination and will be sent to all entities, affected resource agencies, and Indian Tribes.

An entity, affected resource agency, or Indian Tribe may file comments in response to the preliminary determination. A fish and wildlife agency may require a meeting or other procedure to attempt to resolve any preliminary determination of inconsistency. FERC staff members will attempt to resolve the differences with the resource agencies, giving due weight to the agencies' expertise and responsibilities. FERC is ultimately responsible for ensuring that each license contains conditions that adequately protect, mitigate damages to, and enhance fish and wildlife resources in the project area.

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9.0 CONSISTENCY WITH COMPREHENSIVE PLANS

This chapter meets FERC requirements by providing a discussion of the extent to which the primary alternatives are consistent with qualifying comprehensive plans as defined in 18 CFR 2.19 as a result of proposed operational or facility modifications. FERC publishes a list of comprehensive land and resource management plans that must be evaluated for consistency. The list of plans for the State of California identified as of March 2002 was reviewed to find plans relevant to this project. In addition, this chapter will discuss the extent to which the primary alternatives are consistent with other appropriate comprehensive plans identified through the collaborative process. The existing levels of consistency with all such plans (see Table 9.0-1) is the baseline condition that will be used when evaluating the primary alternatives.

FERC requires an applicant to determine the primary alternatives' level of consistency and document relevant communications with state and federal agencies that have land use and resource management authority in the project area. That documentation will be included in this chapter. Finally, this chapter will also include documentation of cooperation with local, State, and federal agencies regarding lands adjacent to the project area that may be impacted by the primary alternatives.

Table 9.0-1. Relevant comprehensive land use and resource management plans in the Oroville project area.

Agency	Document Title	Date	FERC Identified Plan
FEDERAL			
USFS	Plumas National Forest Land and Resource and Management Plan	1988	No
USFS	Sierra Nevada Forest Plan Amendment	2000	No
USBR/ USFWS	Record of Decision for Title 34 – Central Valley Project Improvement Act (CVPIA)	2000	No
BLM	Redding Resource Management Plan and Record of Decision	1993	No
USFWS	Final Restoration Plan for the Anadromous Fish Restoration Program	2001	No
CALFED	California's Water Future: A Framework for Action; Record of Decision	2000	No
STATE			
DPR	California Outdoor Recreation Plan	1994	Yes
DPR	Public Opinions and Attitudes on Outdoor Recreation in California	1997	Yes
DPR	Lake Oroville State Recreation Area Resource Management Plan and General Development Plan	1973	No
DWR	The California Water Plan Update	1994	Yes
DWR	Lake Oroville Fisheries Habitat Improvement Plan	1995	No
DFG	Oroville Wildlife Management Area Management Plan	1978	No

Table 9.0-1. Relevant comprehensive land use and resource management plans in the Oroville project area.

Agency	Document Title	Date	FERC Identified Plan
DFG	California Regulations on Hunting and Other Public Uses on State and Federal Areas	2002	No
CDF	Fire Management Plan	2001	No
CDF & SBF	The California Fire Plan	1996	No
LOCAL			
City of Oroville	General Plan	1995	No
City of Oroville	Bicycle Transportation Plan	1998	No
Butte County	General Plan	1996	No
BCAG	Butte County Bicycle Plan, Butte County 2001 Regional Transportation Plan	2001	No
BCAG	Countywide Bikeway Master Plan	1998	No

Notes: BCAG = Butte County Association of Governments; CALFED = CALFED Bay-Delta Program; CDF = California Department of Forestry and Fire Protection; DPR = California Department of Parks and Recreation; DWR = California Department of Water Resources; SBF = State Board of Forestry; USBR = U.S. Bureau of Reclamation; USFS = U.S. Forest Service

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THE ADVISORY COUNCIL ON HISTORIC PRESERVATION

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THE DANGERMOND GROUP

HELEN SELF
THE DANGERMOND GROUP

PETE SODERBERG
THE DANGERMOND GROUP

MICHAEL ROBERTS PROJECT MANAGER
THE NATURE CONSERVANCY

JIM BOYD ENERGY ADVISOR TO THE SECRETARY
THE RESOURCE AGENCY

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THERMALITO IRRIGATION DISTRICT

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CALIFORNIA HYDROPOWER COORIDNATOR
TROUT UNLIMITED OF CALIFORNIA

STAN GRIFFIN
TROUT UNLIMITED OF CALIFORNIA

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TUDOR MUTUAL WATER COMPANY INC

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ANTON A KISMETIAN
TULARE LAKE BASIN WATER STORAGE DISTRICT

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BRIAN DOYLE CHIEF OF ENGINEERING DIVISION
US ARMY CORPS OF ENGINEERS

W CRAIG GAINES
US ARMY CORPS OF ENGINEERS

PAUL PUGNER
US ARMY CORPS OF ENGINEERS

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US ARMY CORPS OF ENGINEERS

BRETT WHITIN
US ARMY CORPS OF ENGINEERS

WALTER YEPP CHIEF OF PLANNING SECTION
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BARRY MORTIMEYER POWER OPERATIONS
US BUREAU OF RECLAMATION MAIL CODE CVO-600

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US DEPARTMENT OF THE INTERIOR

KERRY A O'HARA
US DEPARTMENT OF THE INTERIOR

PATRICIA PORT ENVIRONMENT REVIEW OFFICER
US DEPARTMENT OF THE INTERIOR

GLORIA D SMITH ATTORNEY AT LAW
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US FISH & WILDLIFE SERVICE

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US FISH & WILDLIFE SERVICE

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US FISH & WILDLIFE SERVICE

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US FISH & WILDLIFE SERVICE

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US FISH & WILDLIFE SERVICE

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US FISH & WILDLIFE SERVICE

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US FISH & WILDLIFE SERVICE

WAYNE S WHITE FIELD SUPERVISOR
US FISH & WILDLIFE SERVICE

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US FOREST SERVICE

SHAYNA J GRAHAM
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YUBA COUNTY WATER AGENCY

STEVE ONKEN
YUBA COUNTY WATER AGENCY

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FLOYD BYRD

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CHANG LIU
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VICTORINO LOPEZ
GEORGE LOSNESS
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KENT LUNDBERG
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JIM PURSELL

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WAYNE STOUT

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GILL TRUST

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CLAY YERBY

AMERICAN TIMBER COMPANY INC.

BENNETT TRUST

BUTTERFLY VALLER CORP

CALIFORNIA WATER SERVICE COMPANY

CHARLES U. BALLARD INTERVIV OS TRUST

CITY OF OROVILLE

COUBERLY 1998 TRUST

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ELLEN G. FRASER TRUST

ESTATE OF RODGER TERRENCE MILLS

FEATHER RIVER TERRACE

FLANAGAN REVOCABLE TRUST

FRANK RIZZO 1998 TRUST

FULL GOSPEL CHURCH OF TRES VIAS

G. GORDON WILLIAMSON EXEMPTION TRUST

GINSBURG LIVING TRUST

GOLD BEACH AVIATION COMPANY INC.

GOODALL ESTATE CO.

GOUGH FAMILY TRUST

GRAN FAMILY LIMITED PARTNERSHIP

HANNON BEINHOFF TRUST

HAWES REVOCABLE TRUST

HEINZ FAMILY LIMITED PARTNERSHIP

HELEN GABRIELLE SCHWEITZER TRUST
HOSPITAL FOUNDATION ENLOE

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JOAN M. HANSON TRUST

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LABELLA FAMILY TRUST

LASSEN FOUNDATION INC.

LEFFLER TRUST

MARILYN C. WILLIAMSON TRUST

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MAXINE I. MORRIS TRUST

MIDDLETON EXEMPTION TRUST

MUNOZ FAMILY TRUST

NBC LEASING INC.

NORRIS C. GODSEY REVOCABLE TRUST

NOVAK FAMILY TRUST

NRLL INC.

ORR TRUST A

OWEN O. MOORE FAMILY TRUST

PARADISE DEVELOPMENT SPORTSMANS

PAULYNE SWATON (DEC'D) TRUST

PEARSON FAMILY TRUST

PERRANDO FAMILY TRUST

PRESERVATION TRUST

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RED HILL RANCH INC.

ROBERT C. NELSON REVOCABLE TRUST

ROBERT E. MEYERS TRUST

ROBINSON & SONS

ROBT. BANES LAND LEVEL & HEAVY EQUIPMENT

RODNEY BUSK TRUST

ROY H. MARTIN TRUST

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SCHULTZ FAMILY TRUST

SILLER BROTHERS INC.

SOPER COMPANY

SOPER COMPANY

STATE OF CALIFORNIA

TAYLOR FAMILY TRUST

THE HEARST CORP.

THE VILLAGE COMSTOCK

TRICKETT FAMILY TRUST

UDOVICH FAMILY TRUST

WAREN MOFFITT FAMILY TRUST

WARSHAWER TRUST

WEBB TRUST

YEAGER INC. DEFINED BENEFIT PENSION